THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIV. No. 1377.] LONDON, OCTOBER 1, 1889. [41ST YEAR. Price 6d.

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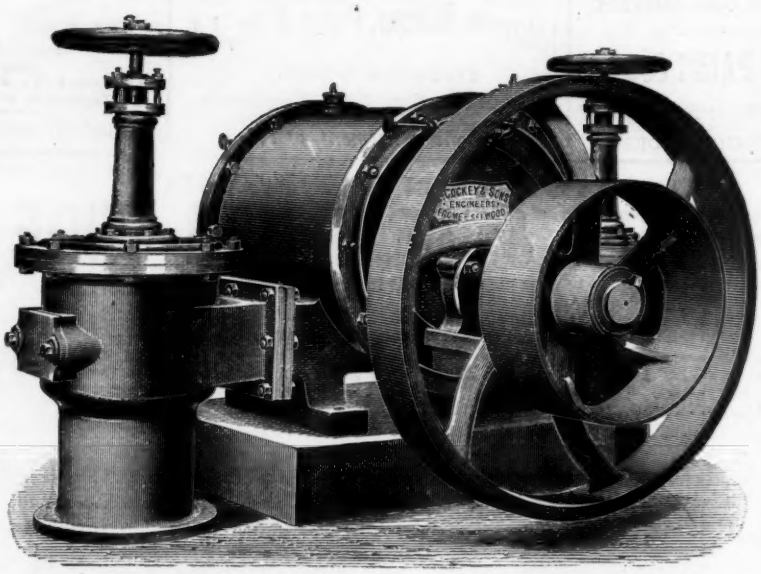

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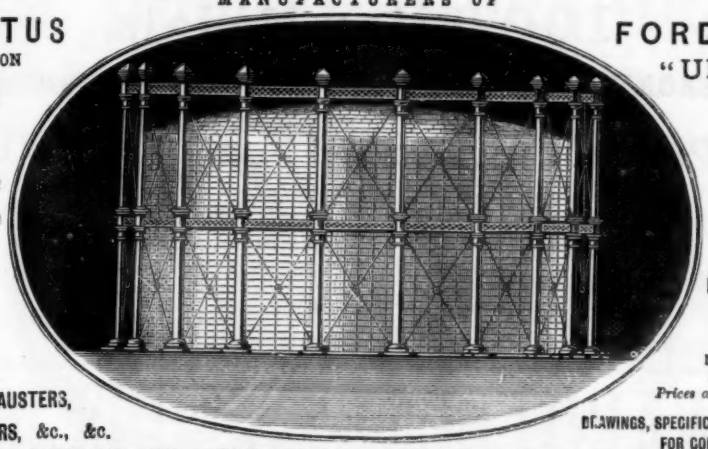

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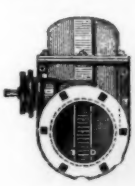

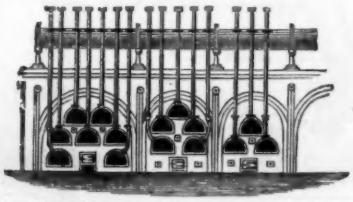

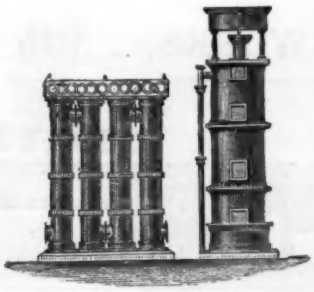

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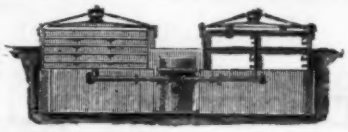

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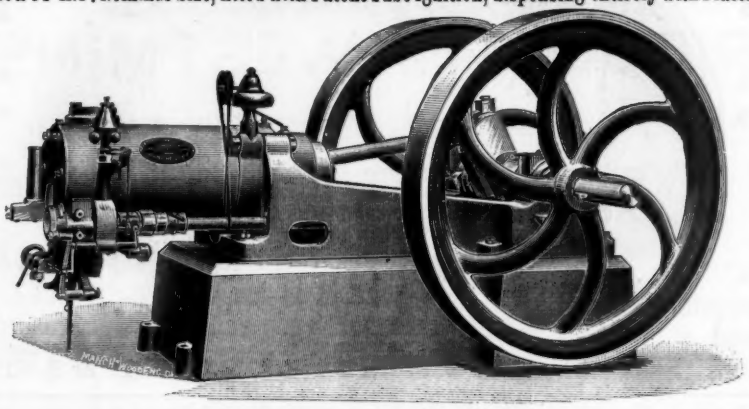

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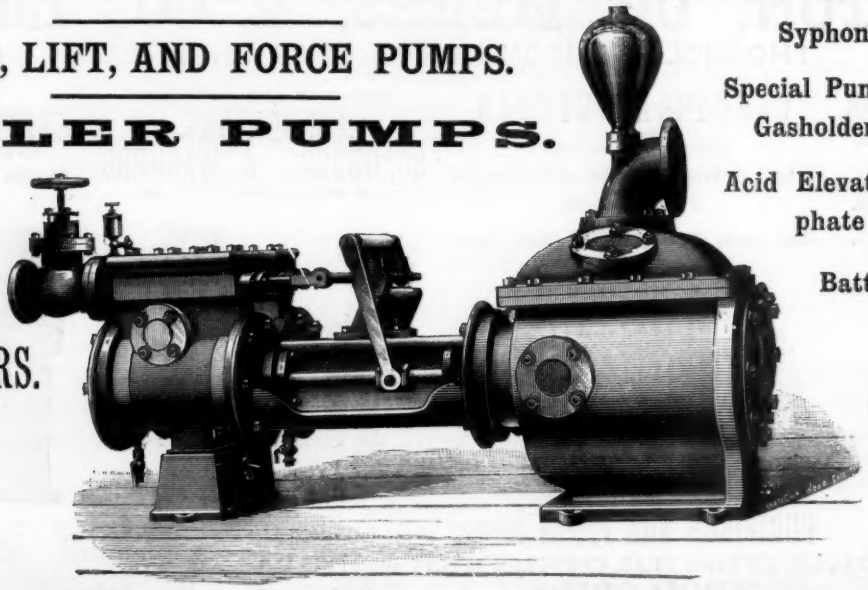

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As supplied to and in course of construction for —

The Gaslight and Coke Company, Beckton Station.
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The South Metropolitan Gas Company, Vauxhall Station.
The Liverpool United Gas Company.
Barry and Cadoxton Gas Company.
Hitchin Gas Company.
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Workington Corporation.
John Brown and Co., Limited, Atlas Steel Works, Sheffield.

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A very large amount of patronage has been accorded the "Standard" Washer-Scrubber, of which, up till now, **367** have been supplied, representing a daily make of **318,260,000** cubic feet of gas; but the advantages of the **"New Standard"** will be readily recognized, and its superiority over the present "Standard" may be briefly summarized as follows:—

1. The weight in motion is **only one-seventh** of that in the present machine.
2. It requires **only one-seventh** the power to drive; consequently effecting a large reduction in cost of Engine as well as in steam power.
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4. It has been found that the washing surfaces **keep perfectly clean** and free from deposit from end to end of the Machine.
5. It is so constructed that it forms a most powerful, effective, and complete system of purification, gives no pressure, and can be removed and replaced without trouble or injury.
6. The "New Standard," owing to the foregoing, can be supplied at **a large reduction in price.**

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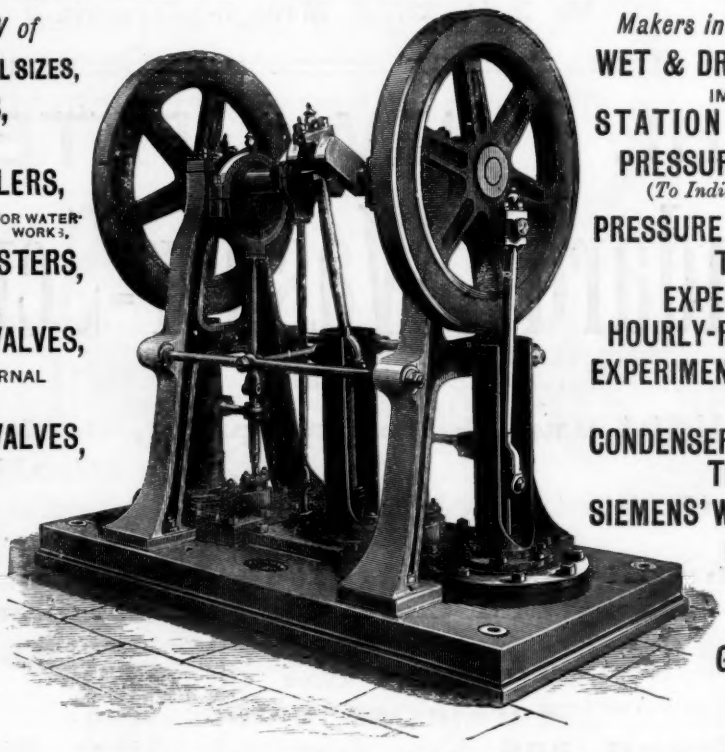

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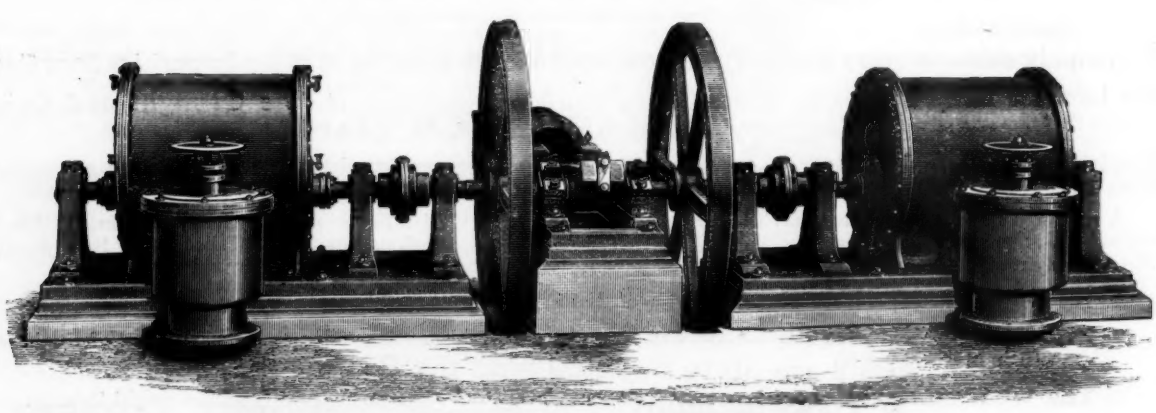

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WITH

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AND

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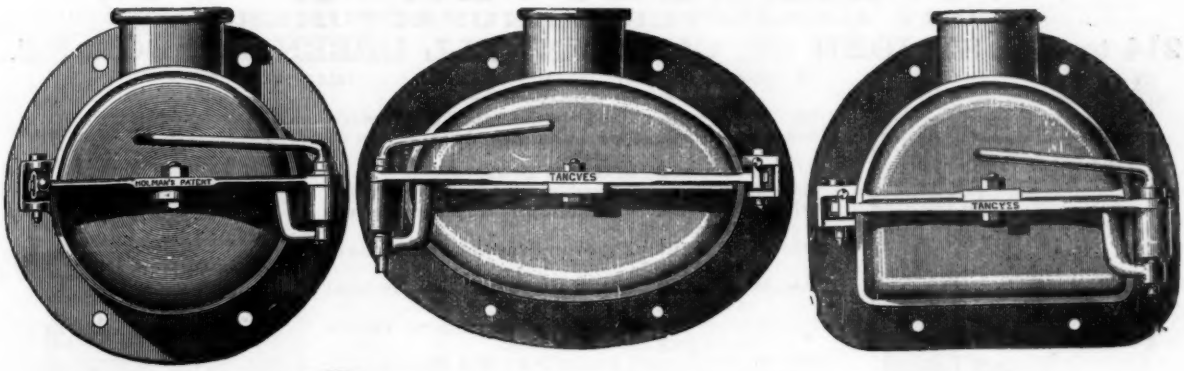
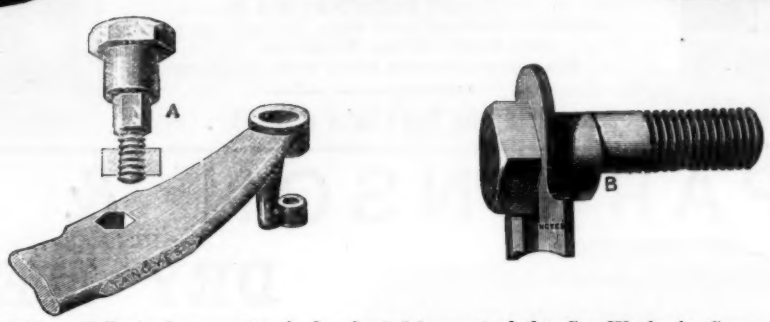
All Retort-Lids and Fastenings supplied by TANGYES LIMITED are now fitted with Carpenter's Patent Fastening, free of extra charge.





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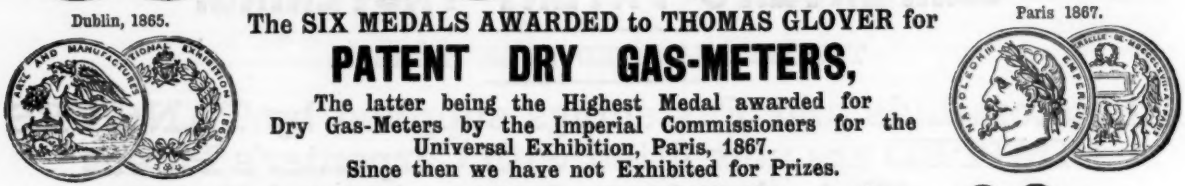

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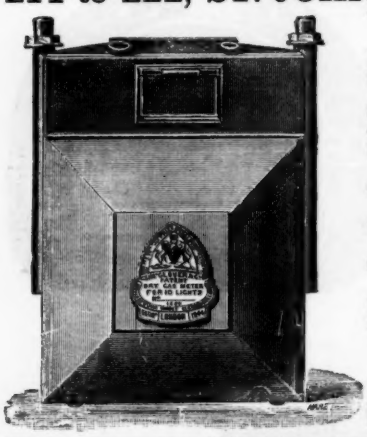

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Meters fitted with Grey's Index or Harding's Counter.

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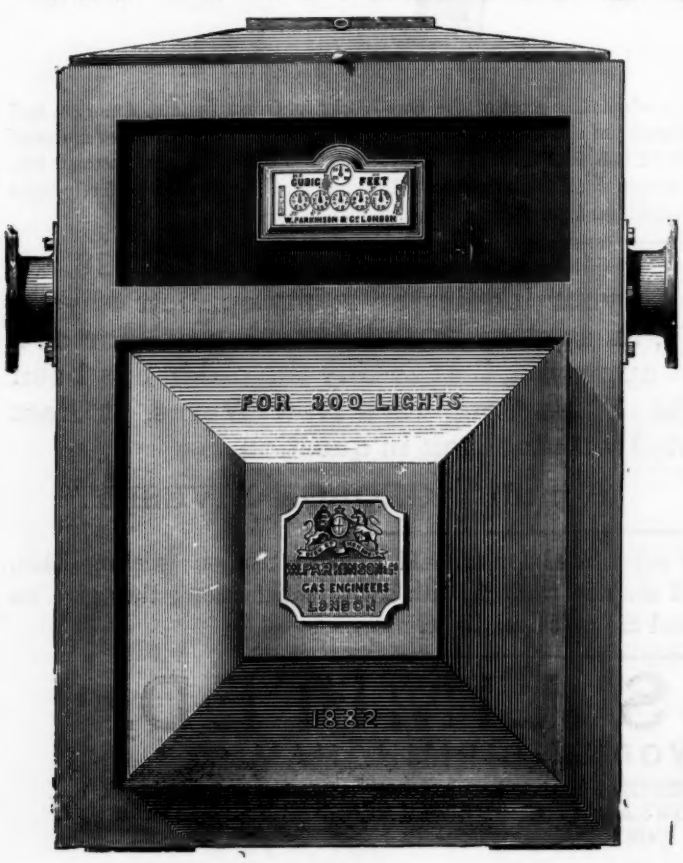

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STATION METERS & GOVERNORS,
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TO ADVERTISERS.

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Telegraphic Address: "GASKING LONDON."

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 1, 1889.

GAS STOKERS AND THE LABOUR QUESTION.

THE air during the past week has been full of rumours of labour combinations; and it is evident that the present agitation among some of the multitudinous and multifarious orders of the industrial world of London will not calm down until there has been a good deal of readjustment of conditions of work and wages, which in some cases have endured so long as to have appeared to partake of the character of the much-quoted laws of the Medes and Persians. It is gratifying to be able to state that an improved feeling appears in the relations between the gas stokers and their employers; and there is now a much better prospect of the establishment of the "trade" of gas stoking, if it may be so termed, upon a footing where managers and men may stand firmly. The Stokers' Union has probably been strengthened by the accession of fresh members, and the formation of additional lodges by the energy of the General Secretary (Mr. Wm. Thorne); but its managers have learnt that their best policy is to work with, rather than in opposition to, Directors and Engineers. There have been during the past few weeks many conferences between Engineers and stokers' delegates; and it is not too much to say that one result of these meetings has been an increased mutual respect. When the circumstances are considered, it will be easily perceived that there cannot be, in the ordinary way, any exchange of views between the head of a large gas-works and an individual stoker. The stokers have their foremen to deal with in the first place; and the Engineer cannot know how many matters concerning the men, which he would like to settle personally, never get beyond the foreman. Likewise, when the Manager has any project in view concerning which he might desire to sound his men, he is liable to a great extent to be guided by the foreman, who is sometimes not wholly in touch with those under him. Consequently, in the course of time, grievances and misunderstandings, originally insignificant, accumulate, and obstruct the course of that silent current of sympathy between employers and employed which always flows when the men esteem and trust their superiors, and these, for their part, treat their workpeople in a spirit of justice that does not exclude liberality. Out of the materials thus collected, the agitator fabricates a fabled mountain of oppression, in which the workman believes for a time. In the case of the London stokers there has been a good deal of this magnification of trifling hardships, and a tremendous parade of effort to obtain a victory in regard to the eight-hours movement, which was not really required in the absence of opposition. That there was any sufficient cause for the starting of the Stokers' Union we cannot believe, when we remember the benefits that the men received without it. Mr. Thorne and his colleagues may flatter themselves, and persuade the men, that it was through the Union alone that the eight-hour shift was obtained; but they cannot pretend that the Union had anything to do with the suspension of Sunday labour, the granting of holidays with full pay (in some cases with double pay), the help stokers have received towards their provident, sick, and pension funds, the provision of reading-rooms, and many other ameliorations of the modern stokers' lot, that cause it to contrast very favourably with that of his precursor of a generation ago. Therefore, to say, as some perfervid Unionists have said, that there is no help or hope for the men outside of the Union movement, is absurd. We do not advance this consideration from any desire to glorify Directors and Managers, or to discourage men from attempting to improve their condition in a legitimate way by combination. Besides what has been done, there may be other things calculated to benefit the workman which he can suggest for himself; and there is no reason why he should not prefer his reasonable requests with all the additional force of a united policy. After all is said that can be advanced for the Union, however, we believe that time will show its superfluous character. The current of labour agitation has of late risen high enough behind that barrier of little grievances and misunderstandings to which we have already alluded, to sweep them all away. It would be foolish to presume that the management of all or any of the London gas-works is perfect, or that incidental cases of hardship to men have not occasionally arisen, as they will continue to arise until mankind arrive at theoretic infallibility. The combination of the men has done enough to cure any actual cases of this kind, and to check their occurrence for the future. More than this it cannot do; and in our opinion the men will soon perceive that the machinery of a Trade Union is disproportionate to the only useful work it is capable of doing for them. Nobody wishes to break down the Union by force; but in time it will in all probability fall to pieces from sheer inutility.

There are a few points arising out of the present agitation that deserve to be more clearly defined than they have hitherto been, even by those who have been fighting round and about them. We are disposed to call them the Charter of the Union Labourer, for we have never seen another equally concise and comprehensive statement of the men's case, stripped of all rhodomontade. They are as follows:—(1) Every man has a right to his employment contingent on good conduct; (2) No alteration of the nature or amount of work to be made without mutual agreement; (3) Facility of

access to the Superintendent and Directors without the filtration of requests through foremen; (4) No unfair preference to be shown between men on account of any consideration arising outside the work for which they are paid. To judge from recent language of the Union leaders, they want nothing more than this. Many managers may truly declare that in none of these points do they knowingly offend; but it is quite possible that stating them categorically may help to remove illusions. Take the first point, for instance. It means that when a man is taken on at a job of stoking, or anything else which he is competent to do, he is not to be arbitrarily discharged simply because somebody higher in the same service happens to dislike him. Although this principle is fully acknowledged and acted upon in some places, it is not so universally; and only a short time ago it was generally held as the most indisputable of commonplaces that the master had a perfect right to discharge any man after the customary notice, without assigning a reason to him or to anybody else. It was an attribute of the *status* of an employer. The principle just formulated, however, is the precise contrary to this assumption, and means that the day labourer has rights as well as duties, which rights public opinion and the sympathy of his fellows will enable him to enforce. There is no law in the statute-book, or even in the common law of the land, to prevent arbitrary action on the part of employers; but this is a matter in which the sense of the community would hold the sufferers justified in combining for their own protection. In the case of salaried officers, the law will help a victim of oppression to recover damages for wrongful dismissal; but the day labourer has no such resource. With regard to the second point, there is little doubt that a clear understanding will prevent those wild assertions that have been made at stokers' meetings, of "engineers putting a foot on the length of the scoop, and "thinking the men would never find it out." Of course, every man who heard the story would reflect that this must have happened at some other works than where he was employed; but that it could really happen he takes for granted. Then with regard to the third point, it may strike some readers that in stating it we are guilty of casting an undeserved imputation upon a most valuable and worthy class of men; but nothing is farther from our intention. Foremen are the sergeants of the industrial army; and it could do very little without them. If the statement of the requirement pricks anybody, it is those Engineers and Superintendents who have got in the way of seeing everything through their trusted foreman's spectacles. Every rank in the gas industry has its duties; and if these are too much devolved, or if responsibility is diffused through too many grades, there will be trouble somewhere. The facilitation of access from the lowest rank of the industrial community to the highest in the same service, is rather pleaded for on the democratic basis that, man for man, there is no essential difference between the engineer and the stoker, but that, being included in a common humanity, one ought to be able to speak to the other freely respecting matters of mutual concern. Practically, it is preferable for men who have, or imagine that they have, a grievance to lay it before their superiors themselves, than to conceive the notion that they must obtain the help of some professional agitator or demagogue to speak for them. Men sometimes entertain absurd and utterly baseless notions of the vindictiveness of their superiors; and it is this feeling of distrust that the agitator finds his profit in cultivating. As to the last point, mutual forbearance is a lesson that people in general who happen to fall out when they ought to be friends find most difficult to learn. The Society man can with difficulty keep his hands off the "blackleg;" and, similarly, the employer can hardly restrain himself when he has a chance of paying off old scores against a workman whom he has reason to accuse as a "firebrand." It is against human nature for either employer or workman to pardon the man who has, as he thinks, injured him, when the opportunity for vengeance presents itself. Yet the victory must be won, if peace is ever to be secured. An instance in proof has been supplied during the past week by the Engineers and the Union hands in the employ of the South Metropolitan Gas Company. Here an agreement has been concluded between the two parties, that bids fair, if carried out, to settle more questions than that which brought it about. The Managers engage that participation in the recent agitation is not to be marked against a man to his detriment; and the men promise not to annoy, or in any way interfere with, non-Union men. They ask that the scoop-gangs of three men shall not be composed of mixed elements—Union men and non-Union men at the same scoop; but they do not object to a retort-house being manned with non-Union men to compare with a house worked by Union men, or even to opposite or adjacent gangs being similarly contrasted. In this way, it will soon be found out what the Union is worth.

We have discussed this subject fully and frankly, with a leaning, if any, towards the men's views, so far as these can be regarded as reasonable, because there is not the slightest doubt, as we have stated in previous comments upon the labour question, that if the men were to become unreasonable, and force the London Gas Companies to defy them, they would certainly be defeated. The Union officials may boast of their great success when there has been no fight; but if there should be a fight, they would sing in a different key. Such advantages have the London gas stokers, that there are two men who could be had at short notice for every man discharged, if the worst came to the worst. We do not believe in anything of the kind, however, as a possibility of the future. The Union leaders are very confident now; but when they have a year's experience they may begin to think whether, after all, the "game is worth the candle." There was a mass meeting of the Union on Peckham Rye last Sunday week, at which the General Secretary spoke, and even so early he gave a hint that the Society must go farther afield than gas making if it is to find work to do. He promised that its power and its funds should be used for attempting to secure the eight-hour day for all labourers'; and declared that even street sweepers would be welcome if they thought they could better their condition by joining the Union. Mr. Thorne deserves credit for the catholicity of his views, and the breadth of his aspirations for the improvement of his kind; but the practical question is, whether the programme is not more than he or his Union are capable of performing. Are the gas stokers prepared to contribute their twopences weekly until the *desideratum* of a shilling an hour for eight hours a day is universally attained? We believe after a time they will grow tired of the effort, and relinquish the reorganization of the labour of the country to those with more time and money to spend upon this object.

THE REPORT AND ACCOUNTS OF THE COMMERCIAL GAS COMPANY.

The report of the Directors and the statement of accounts of the Commercial Gas Company for the half year ending June 30 will be found in another part of to-day's issue; the meeting being called for Friday next. The report contains no remarks of any kind relating to the working of the undertaking; merely stating there has been a net profit of £51,949. With interest and money brought forward, this makes a lump sum of £113,736. Dividends after the rates of 13¾ per cent. per annum on the old stock, and of 10¾ per cent. on the new stock, are recommended, which will leave £66,011 to be carried forward to the next half year. The accounts show the Company's revenue from gas to have been £115,942, as compared with £116,947 last year, when the price was higher. Residual products have improved from £37,523 to £41,352. Altogether, notwithstanding the reduction in price, the gross revenue has risen from £157,308 to £159,691. On the other side, gas manufacture cost £87,905 last half year, as compared with £85,972 in 1888, and some of the other charges are heavier; so that the expenditure was £107,741, against £105,141. The balances carried to the profit and loss account for the two periods are very nearly the same; the last being £51,949, and that of a year ago £52,166. The quantity of gas accounted for shows an increase of 1·69 per cent., which is less than the growth noted at this time last year, but is not at all unsatisfactory, having regard to the character of the Company's district. These accounts prove that the Company are fairly participating in the prosperity of gas undertakings in London and throughout the country generally.

ELECTRIC LIGHTING INFORMATION FROM STAFFORD.

In another column will be found instructive reports by the Town Clerk of Stafford (Mr. M. F. Blakiston) and the Gas Engineer (Mr. J. Ferguson Bell) upon the position of the Corporation with regard to electric lighting. Mr. Blakiston simply states the law on the subject, and gives the procedure to be followed by local authorities and companies under the Electric Lighting Acts; but Mr. Bell goes into the circumstances attending the establishment of an electric lighting plant by the Corporation, supposing it should be deemed advisable for them to take the matter into their own hands. He considers that it would not be prudent to do this unless subscribers for at least 2000 incandescent lamps could be

depended upon at the start. Upon the supposition that this amount of business could be secured, Mr. Bell advises the establishment by the Corporation of an alternating transformer plant, the particulars of which he sets out in full, at an estimated cost of £14,500. Mr. Bell's scheme is worth studying, for he has evidently taken great pains to get together the necessary information for the guidance of his Committee; and as he has nothing to gain by falsifying figures, his estimates are probably worth more than those of any interested electrician whom the Corporation could have called in. If anything, Mr. Bell's comparison of the cost of electric lighting and of gas, errs on the side of the former; but this only shows how anxious he has been not to show bias. For example, he takes the quantity of electricity known as a Board of Trade unit, as being equal to 100 cubic feet of gas; but this is only true when the gas is supposed to be used with a common flat-flame burner, and when the electric lamps are new. That is to say, he takes gas at its least value to the ordinary consumer (which is reasonable enough), and the electric lamp at its best, which, as a notorious fact, it does not maintain for very long. The older the lamp, the less light it gives for the same current; and if it lasts long enough, it looks in time not much brighter than a freshly blown-out wood match. Then it must be replaced, at a cost of 5s. This ought to be done at least twice a year, to say nothing of breakages. Taking this factor of renewals and the diminution of light from incandescent lamps together—and they are really inseparable from their use—the multiplier for the unit-price of electric current to find the equivalent cost of gas of 16 or 17 candle power should be 13 instead of 10, as taken by Mr. Bell.

A REVELATION FROM SALFORD.

Salford gas affairs continue to receive a large share of public attention in the neighbourhood of Manchester. All sorts of sensational stories are daily set afloat, with an industry which does at least as much credit to the imagination as to the discretion of their inventors. During the past week readers of Lancashire papers have been informed, with more or less of circumstance, that the Government have decided to grant a Royal Commission of inquiry; and, what is more startling still, that Hunter has resolved to make a "clean breast" of all his past iniquities, and to turn a flood of light on to the dark pages of the history of the Salford gas undertaking. Perhaps the "dead" season is responsible for the fact that these statements, and others of like kind, have only been made to be contradicted. With Parliament out of session, the dockers' strike ended, and no direful tragedy to arouse popular sympathy and send up sales, sub-editors of daily papers are, no doubt, a trifle hard-set for "copy." The wonderful inventions of the Salford agitators have thus obtained a prominence which they did not merit, even as works of fiction, and which at any other time they would probably not have gained on any ground. With reference to the statements respecting the suggested Royal Commission, it is only necessary to say that up to the end of last week the Corporation of Salford had not received any communication from the Home Office respecting such a proposal. As it is well-nigh certain that some representation would be made to the Borough Council, and an expression of opinion invited from them, before any definite decision is arrived at, the absence of any such communication is at least negative evidence to the untruth of the allegation respecting the Government's interference. This is strengthened by a statement, made by the Town Clerk to a reporter, that he had the "highest authority" for saying that the Home Secretary has not only not advised the granting of such a Commission, but has as yet received no petition in its favour. The rumours as to the intentions of Hunter may be dismissed with equal readiness. The last person of whom the late Gas Manager of Salford is likely to make a confidant is the meddlesome self-styled "C.E.," who seems to be responsible for all these *canards*. It is just as likely that Hunter has informed this man of his intentions, as that Graves, the late Town Clerk—who went out of the way of his creditors some time ago—has undertaken to return at the bidding of the same individual to give evidence before his imaginary Commission. Of course it is possible that there may be a Royal Commission; and it is equally possible that, in the hope of gaining his liberty or for other reasons, Hunter may tell all he knows. We do not believe, however, that anyone is in possession of such information as would justify the assertion that either of these events will come to pass. All the confident statements which have appeared in print during the past few weeks have been based on conjecture, and are, it seems to us, merely incidents in a gigantic game of "bluff."

PETROLEUM AND GUNPOWDER AT ANTWERP.

The recent disastrous explosion and conflagration at Antwerp is calculated to attract attention to at least one of the circumstances of the increase of the petroleum trade which is not wholly beneficial to the community. It would not be surprising if this catastrophe were to slightly alter the views of many people regarding the wisdom of encouraging a large petroleum trade in a port, as the Mersey Docks and Harbour Board are doing by the construction of huge receiving-tanks. It is reported that on one spot near the general dock system of the Mersey, storeage for 19,000 tons of petroleum is to be concentrated. This may be all right and proper, and tank storeage may be the safest way of keeping the great reserves that are required by the mineral oil trade; but the case of Antwerp is not very comforting. Captain Shaw, of the Metropolitan Fire Brigade, has been to see the site of the explosion and fire, which lasted a week; and it may well be understood that he did not inspect the smoking ruins without a shudder at the thought which must have arisen in his mind that something like it might occur at any time on the Thames, if he and one or two other men in authority were to fail in foresight or vigilance. It is difficult to conceive that any governing body could permit the establishment, in the vicinity of petroleum stores, or indeed anywhere near a town, of a factory for breaking up condemned military cartridges; yet this was the case at Antwerp, owing, it is reported, to a defect in the Belgian law relating to explosives, which enables a central authority to override the objections of the local administration. The cartridge-demolishing factory was started last March, and carried on quietly enough until the 6th ult., when an explosion occurred which killed everybody in or near the works, and set alight the petroleum in the neighbourhood; or (as is alleged on the part of the factory proprietor) the fire originated in the petroleum-sheds, and communicated to his building. It is at any rate certain that petroleum and gunpowder are dangerous neighbours, and should be kept as widely apart as possible. The question arises, When may petroleum be considered as safely stored? There are, of course, many substances even more dangerous than petroleum, which the complex needs of modern civilization have erected into commodities that must, of necessity, be stored and dealt with in large quantities somewhere. Petroleum, however, is such a cheap, common article of commerce, wanted everywhere, that to say it must always be put out of harm's way is as much as to say that it shall be deprived of its universal market. It is nevertheless necessary to remember that a petroleum fire is a terrible thing, inextinguishable while the supply lasts, and peculiarly qualified to communicate fire to everything combustible that it may touch. The only thing to be done is to ensure, as far as possible, not only that it shall be safely kept, but also that when it does escape and ignite it may have plenty of room to burn in, with as little harm to anything else as can be provided for. If it had been a gas-works that had done all this mischief at Antwerp, it would have been long before we should have heard the last of it. Being a petroleum store, after the first sensation of horror and fright has passed off, little more is thought of the matter.

The General Committee of the British Association have made the following, among other, grants of money for scientific purposes:—Electrical standards, £50; recording results of water analysis, £10; inquiry into the subject of underground waters, £5.

In Mr. W.J. Dibdin's report to the County Council on the quality of the gas supplied to the Metropolis during the week ending the 21st inst., it is stated that the gas as tested at the Blackfriars Road station on the previous day was 15·8 candles; the mean for the week being 16·3 candles.

The Notification of the Metropolitan Gas Referees for the ensuing winter season contains, besides the usual intimation as to the increase, to 22 grains per 100 cubic feet, in the quantity of sulphur allowable in London gas, a few textual changes which it may be well to notice. In addition to the gas in the photometer having to be kept burning for at least 15 minutes before any test is made, it is ordered that none shall pass through the meter attached to the photometer except that which is consumed immediately before or in the operation of testing. The correction of the volume of the gas may now be made either in the manner described in the Instructions, or by "multiplying the observed illuminating power by the reading of the aerorthometer." The particulars of each test are to be entered "*during or* immediately after" the testing. The two words in italics are additions to the previous Instructions.

Water and Sanitary Affairs.

The Worcester Congress of the Sanitary Institute, although fairly successful in its way, has not been a particularly brilliant affair. It has been the subject of a sarcastic leader in *The Times*, which has roused the ire of the Honorary Local Secretary, Dr. William Strange, who says he is informed "on the best authority," that the article was "most probably" written by a gentleman who was disappointed in not obtaining the office of President of the Congress; but we confess to a little difficulty in conceiving the writer of the leader as having the least notion of taking such a post. The article in question has its point, in showing that many of the insanitary conditions which now afflict us are the products of our civilization, and are associated with scientific processes. Thus our systems of sewerage send poisonous gases into our houses, and polluting liquids into streams otherwise pure. Science does a certain amount of mischief, and then looks about for a remedy. Remedial measures, as proposed at Worcester, do not promise much. But, despite *The Times*, there was something to be said as to the progress already made. In an address on "Sanitary "Engineering," Mr. Henry J. Marten, President of one of the Sections, and Engineer to the Severn Navigation, made reference to the Water Supply of London; saying he remembered the time when the Metropolis was supplied with water from the Thames between Battersea and Vauxhall. To Sir Edwin Chadwick and his medical staff, Mr. Marten ascribed the merit of bringing about a better state of things. He might have gone a step further, and given credit to the Metropolitan Water Companies for their successful efforts to improve and enlarge the supply, so as to keep pace with a population now adding above 68,000 to its number in a single year; the increment being more than half as much again as the entire population of Worcester. Mr. Marten is so far behind in his figures as to state that a constant supply is now given to two millions out of five millions of the population served by the London Water Companies. The population actually supplied exceeds five and a half millions; and the constant supply is given to three and a quarter millions out of this number, instead of simply two millions, The progress made is such that in a year and a half the houses with constant supply have increased from 51 to 58 per cent. of the total, according to the returns issued by General A. de C. Scott. The Vyrnwy reservoir was referred to by Mr. Marten as the last great work of water supply; and benefit to the Severn was anticipated from the compensation water which would be sent down in the summer months, each discharge constituting a small freshet of pure water from the hills.

On the following day, in another section, an interesting paper was contributed by Dr. Percy Frankland, describing some recent experiments in the practical treatment of sewage. The results were said to show that if the only object was to produce a fairly clear effluent, this could be satisfactorily obtained by a number of processes in which chemical precipitation was employed. But in no case was any very great reduction effected in the proportion of dissolved organic matter. If this was to be reduced, recourse must be had to the application of the sewage to land. This may dash the hopes of the precipitationists; but they may at least congratulate themselves on one other statement from so good an authority—namely, that where it is necessary to make use of land, the sewage should invariably be submitted to a preliminary process of precipitation. There is no doubt that this plan is coming very much to the front, and gives scope to the ingenious gentlemen who are so ready with chemical schemes designed to "solve the sewage problem." The only question is, Who can do it at the cheapest rate? But we shall shortly hear more about electrolysis, and perhaps that may put the question in a fresh light. The "Amines" process was duly described to the Congress by Mr. R. Godfrey; and various other methods were discussed by Professor Henry Robinson. The latter thought the time had arrived when an inquiry into the subject of sewage disposal by a competent Commission would yield some valuable results. Another suggestion came from Mr. J. W. Willis-Bund, who proposed a kind of differential standard for sewage effluents, by which varying degrees of purity would be allowed, according to the nature of the river into which the effluent was discharged. Fish-life was made the basis of the proposed standard—fish of the carp family, which characterize certain streams, being much more tenacious of their existence than the salmon class, to be found elsewhere. It seems that the latter have scarcely been experimented upon at all, being generally lucky enough to escape the effluents; and their degree of sensitiveness requires to be further understood. How this proposal stands in relation to the supply of drinking water is not yet explained. That the same effluent is not required in all cases may be admitted; for that which would do no harm at Barking Creek, might be scarcely admissible between Teddington and Cricklade.

An American contemporary, *Progressive Age*, has been urging the advisability of gas companies and builders of gas-engines uniting on some practicable plan for renting them out that would enormously increase the consumption of gas and the use of this kind of power. We are told that electric motors are let out in this way; and it may be presumed that this leads to the introduction of a great many machines that would not be used if they had to be bought outright. No doubt also a large proportion of those so rented out are eventually bought by those who have rented them, after actual use has demonstrated their utility. The same result would undoubtedly follow the renting out of gas-engines; and the fact that one was used with pronounced success in a locality would lead to the introduction of others—some of them by direct purchase, and others on rental. The latter would lead many desiring only temporary power (say for two, four, six, or even twelve months) to rent a gas-engine, and so become, for the time being, large consumers of gas. The demand for running gas-engines would be mainly during the daytime; and, in fact, largely between the hours when gas-stoves were being used for ordinary cooking purposes. Hence, the works could meet this demand with equal convenience.

An example of how little value is attached by the ratepayers of a town to the privilege they possess of deciding by their votes any important question affecting them, is afforded by the result of the recent *plébiscite* on the question of the purchase of the Bournemouth gas and water undertakings, as recorded in the Journal last week. Out of 3600 voting-papers sent out, only 1592 were returned filled up and signed; so that more than 2000 out of the entire number of persons entitled to vote, did not take the trouble to do so. Surely, on a matter involving the expenditure of about £400,000, the apathetic 2000 must have had some opinion; and, if so, it is to be regretted that they did not express it. The fact of their not doing so will, as pointed out by a local paper, shake the faith of many people, who are zealous for the town's welfare, in the wisdom of seeking arbitrament of the ratepayers in matters of supreme concern to the district. It is thought the apparent indifference to the issue was caused by an imperfect understanding of the bearings of the subject, and the terms on which the proposed purchase was based; as it required considerable patience and mental effort to grasp the whole question, and to compute as nearly as possible the probable and comparative effects of purchase and refusal. But, on the other hand, there was that large body of ratepayers who allow important questions to be thought out and settled by others, and are willing to believe that the course finally chosen is for the best. People of this order of mind doubtless formed a large majority of the 2000 voters who declined to express an opinion on the question submitted to them. It is interesting to note that it was the plural system of voting which brought about this result. Had the single system been in operation, the proposal would have been adopted, as, of the total number of persons voting, 819 were for, and 773 against it.

The New Zealand Legislature have lately been discussing a matter in which all the gas companies in the colony are interested. It appears from a copy of the *Otago Times* which has been forwarded to us by an esteemed correspondent, that in the course of the past session a Bill to sanction the erection of gas-works by the Christchurch Corporation—of course, in competition with those already existing—was ruled by the House to be a Private Bill, and was lost; whereupon the mover introduced a Public Bill, to amend the Municipal Corporations Act, by which he endeavoured not only to obtain the power previously sought for, but a considerf able extension of it. He explained to the House that the effect o his Bill was to enable any corporation to erect gas-works, if desirable, in towns where works already exist. As the law stood at present, he went on to remark, gas consumers were entirely at the mercy of gas companies—a state of things which was never intended. All he wished the House to do by the Bill was to give power to borough councils to remedy this by erecting other gas-works. He asked the House to read the Bill a second time, so as to emphasize the fact that the present state of the law is unsatisfactory. One member expressed the opinion that the Christchurch Corporation had no intention whatever of erecting gas-works, and simply wanted to hold the Bill *in terrorem* over the heads of gas companies, so as to compel them to yield to their demands. He moved the rejection of the Bill. Another member remarked that the Bill was being used as a lever to confiscate private property; and he advised the mover to drop it, and allow the Government o bring in a measure next year to prevent injurious monopoly. A suggestion was thrown out, in the course of the debate, that if the Bill went into Committee a clause should be inserted to the effect that, prior to erecting gas-works, a corporation should intimate to an existing gas company that they were prepared to purchase their undertaking. The Bill was read a second time; and we await advice as to its progress.

Essays, Commentaries, and Reviews.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 657.)

The Bank of England rate was raised on Thursday from 4 per cent. (to which it had been advanced four weeks previously) to 5 per cent. This movement had been fully anticipated, and was thoroughly justified; money being in very brisk demand. The principal event of the week on the Stock Exchange has been the heavy settlement. New business was limited, and prices were irregular. Things in the Gas Department have been interesting; as another run against Gas has broken out. It had been looming in the distance some little time; but apparently the signal for action was retarded until the visit of Mr. Edison to London. By the aid of his oracular utterances, a good spurt has been given to the various electric undertakings; and possibly if he could have been got to dine at the Mansion House, where he was invited, a more powerful post-prandial puff might have been forthcoming. Of course, simultaneously with the booming of Electrics, the bearing of Gas is to be expected; and as soon as the old account was closed, it started. Gaslight "A" was naturally the object. The last price for the old account on Thursday was 261½. Then the drop began; and 257 was marked that day. On Friday it fell to 251; and on Saturday it touched 243, but the latest marks were rather better. We do not believe that more than a small quantity of stock has actually changed hands; and if holders will only keep their heads (and keep their stock too), not much will change hands, and prices will speedily recover. But if they allow themselves to be "funked," they will fall victims to the bears. While Gaslight "A" was being knocked about, the other issues of the same Company and those of the other two Metropolitan Companies remained unmoved; but they will be treated in the same way if a chance is given. Some of the lesser issues—as South Metropolitan "A" and Commercials—are not so likely to suffer; as, from their very smallness, they are dangerous to "bear." Suburbans and Provincials have been firm—especially Alliance and Dublin, and Bromley. Foreign undertakings have been the same; and Bombay has made a further advance. The Water Companies have been very quiet indeed, with unimpaired firmness generally; but Southwark ordinary receded 7.

The daily operations were: Fair activity in Gas on Monday. Dealings were had in many issues, and all at good prices, especially for Gaslight "A," "H," and "J," Imperial Continental, Alliance and Dublin, and Bombay (the latter rising ¾). Water was almost untouched. Southwark fell 1. Tuesday was quieter in Gas, and prices were not quite so good. Gaslight "A" opened at 261½, but finally marked 262½. Nothing at all in Water. Very little was done in Gas on Wednesday, and Gaslight "A" fell 1½. On Thursday attention was almost concentrated on Gaslight "A," which opened at 261½, and fell rapidly to 257; though subsequent marks were better. The quotation fell 3 for buyers and 1 for sellers. Bromley new rose 1½. Very little was done on Friday; but the run against Gaslight "A" proceeded, and the final mark was 251. The quotation was nominal at 250-260. In Water, Southwark fell 6. On Saturday, Gaslight "A" opened at 243; but afterwards touched 246—the quotation being nominally at 240-250, or a further drop of 10. South Metropolitan was marked once "specially" at 235; but the quotation was left unchanged.

ELECTRIC LIGHTING MEMORANDA.

THE "DAILY NEWS" ON THE ELECTRIC LIGHTING OF LONDON—EDISON IN LONDON—THE PADDINGTON VESTRY AND ELECTRIC LIGHTING—OPENING OF THE BRADFORD ELECTRIC LIGHT STATION.

The series of articles on the electric lighting of London, the first of which was noticed in this column last week, has been continued in the *Daily News;* and up to the present there are four of these instructive and amusing essays open to the study of the electrical consumer *in posse*. The authorship of the articles is not declared; but they look extremely like the handiwork of Professor George Forbes, who has on more than one previous occasion constituted himself a chronicler of matters electrical at home and abroad. The second article of the series now under notice is devoted to a glowing—we had almost written an incandescent—account of the Deptford station of the London Electric Supply Corporation, which is supposed to start in operation to-morrow. The third gives a description of the rival "Metropolitan" Company's proposals for lighting a large district from several centres of supply; and both this and the fourth article are pervaded with references to Mr. Edison, who has been in London during the past week, and has inspected the works of both Companies. The description of the Deptford works does not tell us anything new. It consists largely of a glorification of Mr. Ferranti, the Engineer, who is styled the Edison of England; but who has yet to show that his plans for this mammoth establishment justify in the working the implicit confidence that has been placed in them. The most interesting part of these *Daily News* articles is that in which the writer discusses the mutual bearings of gas and electricity. He estimates, to begin with, that there are, at the lowest reckoning, 5,000,000 gas-burners in London, to replace which by means of electricity—this result being taken for granted—will require engines of a total of 250,000-horse power, nearly half of which can be provided on the Deptford site. He then goes on to state, as a way of arriving at the comparative cost of electric lighting and gas, that by Act of Parliament a London electric lighting company may charge 8d. per unit, which is according to him "the quantity of electricity consumed by a 10-candle power lamp in 30 hours." This is clear enough; but then the writer asserts that it has been found by experiment that a gas bill of £24 5s. a year represents with fair accuracy the price of two "Board units." In other words, for £24 5s. a year a householder may have every day as much current as will supply 60 lamps of 10-candle power each for one hour. It is evident that there is more than one step left out in this proposition. Nobody can be fairly expected to follow a proof that jumps at once from a retail selling price for one description of light to some unknown person's bill for a whole year's use of another kind of light, and declares that there is equality between the two. This is just what we cannot determine from the data offered. Then, as the impartiality of the writer cannot be relied on, since he omits to reckon the cost of lamp renewals in electric lighting, while exaggerating the dirt, &c., of gas lighting, and has no better reference to give for some of his statements than Mr. Preece, we consider ourselves justified in regarding these with the utmost reserve.

Mr. Edison has been good enough to express approval of much that he has seen in and about the London electrical supply stations. He went to the Deptford works, and from there he could get a good view of the river; the scene including, as one of its features of interest for an electrician, what the *Daily News* reporter describes as "the unadorned Brobdignagian form of the biggest gasometer in the world, and as far as one knows in the solar system." This is pretty well for description; but mark the ease with which an inspired writer can indite striking reflections on the spectacle of Edison looking at a big gasholder. "The gasometer and Mr. Edison are symbols respectively of the old and new orders of things illuminant; but though the Edisons and the Ferrantis are taking the shine out of the gasometers, they are not necessarily taking it out of gasometer shareholders' pockets." How strange that it never occurred to such a thoughtful person as this reporter to ask how much "shine" Mr. Edison had yet succeeded in taking out of the gasholders of the city of New York, where he has been doing for the last five or six years all that Mr. Ferranti hopes to do in London in the time to come? It would be some slight satisfaction if one could only button-hole this gushing gentleman, who is so ready to tell us how much horse power will be required to supersede by electric lamps all the gas-burners in London, and ask him to explain the phenomenon of the stationary New York Edison plant and the expansive New York Gas Companies. By the way, the reporter made Mr. Edison say that he had 700,000 lamps going in the city of New York; as to which we require distinct confirmation or correction from the other side.

Paddington was one of the London parishes which succeeded in fending off the electrical supply companies at the inquiry before Major Marindin, on the plea that it was about to engage in electric lighting on its own account. The Vestry have fully considered the matter, however, and have come to the conclusion that the work had better be done by a local company acting under their patronage, something after the pattern set by Chelsea, it is to be presumed. There is prudence in this decision; but it can be well understood that it will not be very pleasing to the ambitious companies who would have obtained a footing in the parish ere now but for the action of the Vestry. Paddington has some of the choicest bits of lighting in London to give to any company that can do the work satisfactorily. It is a well-managed parish also, and therefore is not likely to fall an easy prey to mere piratical adventurers who would gladly obtain a Licence, if they could, without providing themselves beforehand with money to carry out their engagements.

The Bradford Corporation electric light works have been opened with some little ceremony, and it is impossible not to wish the experiment a fair measure of success, after all the trouble that the Gas Committee have taken about it. It is to be noticed that Alderman F. Priestman, who has had most to do with the organization of the station, told the local public through the reporters of the opening function that in charging 5d. per unit for the supply, "which was perhaps the lowest rate ever charged by any electric lighting society," the Committee were letting the Bradford consumers have their electric lamps at about double the price of gas. This statement should be collated with the *Daily News* assertion above mentioned, which makes out electricity at 8d. per unit about equal to the price of gas in London. We may be sure that Alderman Priestman did not exaggerate the price of the light which he is naturally so desirous of seeing popularized. The Bradford station will henceforth supply current from an hour before sunset to eleven o'clock, or a little later. Being purely evening work, there should be no difficulty in keeping the plant and machinery in proper order.

North of England Gas Managers' Association.—The twenty-fifth half-yearly meeting of this Association is to be held at Doncaster next Friday, under the presidency of Mr. R. Bridge, the Engineer and Manager of the Doncaster Gas-Works. The members will assemble at the works, of which an inspection will be made; after which they will proceed to the Guildhall, where, by permission of the Mayor (Mr. J. Athron), the business will be transacted. This will consist of the delivery of an address by the President, and the reading of a paper by Mr. J. H. Cox, junr., of Sunderland, on "Gas Popularization." If the business does not occupy too much time, a visit will be paid to the locomotive workshops of the Great Northern Railway Company. The members will, as usual, dine together in the afternoon.

GAS AND LIGHTING ACTS FOR 1889.

According to custom, we now complete our record of the year's parliamentary work by summarizing the Acts relating to gas supply which were passed during the last session. It was not a busy session for gas legislation; only eleven Acts in all having been added to the Statute Book. These are as follows:—

The Faversham Gas Act incorporates a Company formed in 1888 to acquire gas-works property at Faversham. The share capital of this Company was £26,880 divided into shares of £8 each, all issued in December, 1888, as fully paid up, in payment of the purchase-money to the shareholders of the old Faversham Gaslight and Coke Company, then in liquidation. A valuation of the new Company's property showed it to be worth the amount named, or thereabout. The incorporated Company's capital is fixed at £40,000, of which £26,880 is original, and the remainder additional capital to be raised under the auction clauses. Borrowing powers are granted to the extent of £6720 in respect of the original, and £3280 on the new capital. The standard price for the Company's 15-candle gas is to be 4s. per 1000 cubic feet within a radius of 2200 yards from the centre of the works, and an additional 6d. beyond. The Great Wigston Gas Act incorporates a Company formed in 1857. The capital is fixed at £24,000, whereof stock to the amount of £14,000 is substituted for the shares of the limited Company and is called the original stock and £10,000 is the additional capital to be raised under the Act. Borrowing powers are granted to the extent of £3500 on the old, and one-fourth of the amount of the new capital as called up. The standard price for the 15-candle gas to be supplied is 3s. 6d. per 1000 cubic feet. The Woodhall Spa (Gas and Water) Act incorporates a Company with a capital of £25,000 equally divided between their gas and water undertakings, the accounts of which are to be kept separate. The usual borrowing powers are conferred. The maximum of 6s. per 1000 cubic feet for 15-candle gas is fixed as the price of gas until the meter consumption reaches 4 million cubic feet per annum, after which the maximum will be 5s. per 1000 cubic feet.

The Barry and Cadoxton Gas and Water Act confers further powers on the Company. Additional gas capital to the amount of £19,200 is granted, with power to borrow £4800. The Belgrano (Buenos Ayres) Gas Company (Limited) Act extends the Company's powers to include lighting by electricity or any other illuminating agent. The Company's power under their Memorandum of Association to buy their own shares is annulled. The Morley Gas Act enables the Company to raise £40,000 of additional capital, with power to borrow one-fourth of the amount raised. New lands are to be acquired. The maximum price of 16-candle gas is fixed at 4s. per 1000 cubic feet. Different pressures are permitted in different districts. The Company may require prepayment of gas by temporary consumers; allowing 4 per cent. interest on the sums so prepaid. The period of error in defective meters is limited to the current half year, unless the contrary is proved to the satisfaction of the inspector. The Tuscan Gas Act amends the Memorandum of Association of the Tuscan Gas Company to enable them to supply electric lighting in addition to, or in partial substitution for, gas in any place in the Kingdom of Italy where the Company are at the time supplying gas; but only upon the requisition of a competent local authority or under the terms of a concession.

The West Ham Gas Act enables the Company to raise £250,000 of additional 7 per cent. capital, with power to borrow one-third of the amount. The premiums received on the sale of such capital are to be considered as paid-up capital for the purposes of settling the proportionate amounts of loans or of an insurance fund. The standard price for 16-candle gas is to be 3s. per 1000 cubic feet. It is enacted that if the clear profits of the undertaking in any half year amount to more than enough to provide for the insurance fund and pay the authorized dividends, the excess shall be carried forward; provided that if the said excess is more than sufficient to permit of a reduction of one penny per 1000 cubic feet in the price of the gas sold in the preceding half year (as shown by the accounts of the Company) and for the corresponding increase of dividend, the price of gas for the next half year is to be reduced accordingly. Consumers may apply to the Court of Quarter Sessions to order an examination of the Company's books, if necessary, in order to make the foregoing provision operative. The Company may form a reserve fund at their own expense, to which one-half (amounting to £11,500) of the existing reserve is to be added. Borrowing is prohibited except by way of issuing debenture stock by auction, such stock not to carry a higher rate of interest than 4 per cent. per annum save by permission of the Board of Trade. The testing-place for gas is to be not less than 1000 yards from the works. The mode of testing is to be that prescribed by the Referees, with the exception that the testings for illuminating power shall be made at intervals of not less than half an hour each. The purity and pressure of the gas may be tested at any time of the day or night; but the illuminating power only between the hours of 5 and 11 p.m. After the end of next year, the sulphur clauses are to be enforced. The Company must, if required, supply the public lamps by meter.

The Windermere District Gas and Water Act enables the Company to increase their present gas-works capital by the issue of £17,500 of additional shares or stock, with borrowing power to the extent of £3135 in respect of the old capital authorized in 1862, and of one-fourth of the new capital as it is issued. The standard price is fixed at 5s. per 1000 cubic feet. The Burnley Corporation Act extends the borough and the limits of gas supply. The statutory powers of the Padiham Local Board to supply gas in a portion of the extended district are repealed; and the Corporation agree to purchase the mains on a valuation. New gas lands are to be taken, and £30,000 is to be borrowed for gas purposes.

Standing in a category by itself is the Metropolitan Electric Lighting Act, which authorizes the Metropolitan Electric Supply Company, Limited, to erect and maintain electric lines and works, and to supply electrical energy, within the parish of St. Martin-in-the-Fields, in the county of Middlesex, and certain other parts of London. The Act declares that the undertakers are the Metropolitan Electric Supply Company, Limited, of No. 50, Old Broad Street, E.C.; being a registered Company with an initial capital of £500,000 and power to increase this amount. The undertakers are not to purchase or acquire the undertaking of, or to associate themselves with, any other electric lighting concern without getting the direct authorization of Parliament. The district of the undertakers is mapped out; and they agree to relinquish any lighting outside their district which they may actually have in hand as soon as any other statutory undertakers of electric lighting are in a position to relieve them of their responsibility. Within six months after the passing of the Act, and before exercising any of the powers conferred by it, the Company are to satisfy the Board of Trade that they are in a position to fully and efficiently discharge the duties and obligations imposed upon them. A deposit of £1000 is to be made by the Company before they commence work in any local authority's district. The accounts of the undertaking are to be subject to audit. The system of supply is to be subject to the approval of the Board of Trade, and carried on with due regard to other electric circuits at the time being in use for other purposes. Overhead wires are prohibited except by the express consent of the County Council. Elaborate provisions are inserted for the protection of the Postmaster-General and of the local authorities in respect of the wiring of the Company's district. Fourteen days' notice with regard to street-mains, and 48 hours' notice for services, are to be exchanged between the Company and Gas or Water Companies. Electric inspectors are to be appointed by the County Council or by the Board of Trade; and testing-stations are to be provided. Energy is to be supplied on demand; but consumers must enter into a two years' contract with the undertakers. The prices chargeable for a supply are set out in a schedule, which is to be subject to revision at the end of seven years. If charged by quantity, the rate will be 8d. per unit for every unit over twenty, and 13s. 4d. the minimum charge. If charged by time, the amount is to be calculated on the maximum number of hours and the maximum capacity of the lamps. These terms may, however be varied by agreement. Meters are to be used unless otherwise agreed. Power is given for the relinquishing of the whole or any part of the undertaking if the Board of Trade are satisfied that it cannot be carried on at a profit. The County Council are amply protected in respect of the use of their bridges by the undertakers. Within a period of two years after the passing of the Act, portions of the Strand, Northumberland Avenue, Whitehall, and Whitehall Place are to be occupied by the distributing mains of the Company.

Presentation to Mr. W. Duesbury.—After long service with the Derby Gas Company, Mr. William Duesbury is about to leave to take the management of the Cambridge Gas-Works; and he has just been presented by the staff with a gold watch and chain and a Gladstone bag, in token of their esteem. The presentation was made by the Secretary (Mr. Isaac Fisher). Mr. Duesbury has also received a gold watch and an address, and Mrs. Duesbury three old Derby vases from friends at the New Jerusalem Church.

The Danger of Water Gas.—Apart from the danger attending the use of water gas in consequence of the high proportion of carbon monoxide contained therein, there is the difficulty of detecting an escape, owing to the absence of the characteristic odour of coal gas. To obviate this defect, it has been proposed by MM. J. Lunge, O. Wyss, and M. Rothenbach to impart odour by the addition of mercaptan. Some doubt is, however, expressed as to possibility of retaining it during the passage of the gas through the mains; and experiments will have to be carried out with the object of settling this point.

American Gaslight Association.—According to the latest official notice issued by the Secretary of the above Association (Mr. C. J. Russell Humphreys) in reference to the forthcoming annual meeting, which is to be held in Baltimore from the 16th to the 18th inst., no additions have been made to the list of papers to be read on the occasion, as given in the Journal for Aug. 20 last (p. 354); and it is thought that those promised will occupy all the time at the disposal of the members. The "question-box," however—a capital appliance for drawing out members in an informal way—has already been furnished with queries as to the wisdom of allowing a special discount on gas used for cooking and heating, as to the success or otherwise of the plan of introducing air with gas into the purifiers for the purpose of revivifying the oxide, and as to the progress made in the matter of regenerative furnaces. On the last day of the meeting, the Association will enjoy a sail down the beautiful Chesapeake Bay, stopping at points of interest; and during the trip the members will be the guests of the Maryland Meter and Manufacturing Company. An inspection will also be made of the Chesapeake Gas-Works, where the members will be entertained by the officers of the Consolidated Gas Company.

THE MOND PROCESS FOR THE PRODUCTION OF AMMONIA.

The Mond process for the utilization of slack for the production of gas and sulphate of ammonia deserves notice, from the evident care which has been taken to verify every stage in the process, and thus obtain working data strictly to be relied upon. The details are to be found in the second part of Mr. Mond's presidential address to the Society of Chemical Industry, the first portion of which was dealt with in the JOURNAL for Aug. 27. It will be remembered that Mr. Mond has proved that none of the processes patented for the production of ammonia from atmospheric nitrogen could stand the test of a close scientific scrutiny; and that, as a matter of fact, all the ammonia actually obtained under these patents was easily traceable to the coal or other fuel employed, and that the result of carrying out the processes as set forth in the patents, but omitting the admission of air, led to an increase rather than a decrease of sulphate of ammonia produced. Further tests led to the knowledge that the best manner of burning coal so as to obtain its nitrogen as ammonia, was by the use of a current of steam; but that from the somewhat extensive character of the apparatus, and the large amount of material to be treated, the process could not be commercially successful.

It may be of interest to note at this point that an exactly similar conclusion was come to between the years 1881 and 1882. At this time the paraffin industry was undergoing a change. The price of oils, taken along with keen American and Russian competition, had shown the necessity for some new process or adaptation which would yield products at a less cost, or give a greater yield without an increase in working expenses. In April, 1881, Mr. W. Young applied for letters patent for "improvements in the manufacture of mineral oil and ammonia; part of the said improvements being also applicable to the manufacture of coal gas;" and he was followed, about a month later, by Mr. G. T. Beilby, who applied for protection for "improvements in distilling shale or other oil-yielding minerals, and in apparatus therefor." Both patents included the use of steam; and in each case the apparatus had an attachment by means of which the steam was caused to pass through pipes heated externally by waste heat. In actual work it was found that these superheaters were readily burned out, and were very expensive to repair; whilst further trials brought out the fact that the superheating, so far as such was necessary, could be readily conducted in the retort itself. The process was a vast improvement on the older methods; for not only was the yield of oil somewhat increased, but the ammonia obtainable per ton of mineral leapt from 10 to 12 lbs. of sulphate to from 20 to 22 lbs. From this time sulphate of ammonia became a most important part of the paraffin industry, and, indeed, was for some years the paying product in such works.

Further consideration led Mr. Mond to the belief that, whilst steam alone could not be economically employed, if the coal could be burned in gas-producers by the aid of steam with air, the results might be satisfactory, and the gases be available for heating purposes. Here again, curiously enough, Mr. Mond's process seems to come in contact with the patents and the practice of Messrs. Young and Beilby. It may be said that these patents were only intended for use with shales and other oil-bearing minerals; but this is not what is covered by the specifications, nor is it what is actually in use. The heating of the shale retorts under Messrs. Young and Beilby's process is conducted by means of gaseous fuel, obtained by the employment of a producer which does not materially differ from that suggested by Mr. Mond, with probably one exception—viz., that whilst the latter gentleman uses a water-lute for the lower part of his apparatus, Messrs. Young and Beilby have, after trial, discarded this form, as being of less value than the close door. It is very interesting to note how the carefully worked-out scientific investigation of Mr. Mond has led to results almost indentical with those employed by Messrs. Young and Beilby; and we cannot but congratulate these gentlemen on the scientific and practical knowledge, combined with hard work, of which their inventions bear witness.

When Mr. Mond comes to the production of ammonia salts from the producer gases, the apparatus he suggests is not very different from that employed in paraffin works under the patent rights of various inventors; but the solution he uses to wash the gases is, we think, somewhat novel. Instead of vitriol alone, he employs a solution of sulphate of ammonia rendered acid by sulphuric acid. The reason for this is stated to be that a liquid containing a larger proportion than 2·5 per cent. of free acid would act upon the tars, and yield dark-coloured solutions. At this part of the process it appears to us that Mr. Mond has not been so successful as the patentees of the paraffin works' apparatus, as they have no difficulty in separating not only paraffin tars but coal tars from the ammoniacal solutions so completely as to obtain salts with only, at the most, even when working with recovered acids, a grey colour. The additional treatment suggested by Mr. Mond, of washing the liquid with heavy tar oils before evaporation, is not found to be necessary; nor is the addition of lime, as also suggested at one part of the process, found to be advisable, as the amount of fixed ammonia is not sufficiently great to pay for the extra labour involved.

Another point in which the apparatus now before us seems to be defective lies in the practical result that the cinders removed at the lower, or water-lute end, contain about 33 per cent. of carbon. Of course, these are not wasted, but are picked out and returned to the hoppers with the fresh charges of coal. Now, here we seem to have a point still requiring considerable attention; for it can only be a mere matter of detail to so arrange the depth of the producer that the ashes removed at the lower end shall be completely exhausted of their carbon, and not require the extra labour and expense involved in picking and recharging, to say nothing of the loss of heat rendered necessary before the carbon can be utilized, and the water with which they are saturated volatilized. Of course, it may be said that these coke cinders help to keep the slack charged into the producers open and porous; but with a heavy steam-jet, such as is used, there need be no necessity for choking from the caking of the coal. The tar produced amounts to only 3 per cent. of the fuel, and is very thick and of little commercial value. Mr. Mond finds that it can be readily employed for raising steam, and that it is of great calorific value. It seems as if this material could be utilized in some other manner than by merely burning it under boilers. It will very probably contain much nitrogen; and if subjected to combustion with a jet of steam in the presence of air, it might be compelled to yield a fair return in ammonia, besides doing work as gaseous fuel. The tars obtained from the Young and Beilby producers working coal are regularly sold to the distillers, and are found to be rich in the benzols as well as the creosotes, and contain anthracene as well as naphthalene and paraffin.

As to the comparative production of sulphate of ammonia by the Mond and the Young and Beilby processes, we have not so much to go upon, although the figures at our disposal are valuable. Mr. Mond states that by his process about one-half of the nitrogen of the coal can be obtained, which is equivalent to about 70½ lbs. of sulphate per ton of mineral. The Young and Beilby process, as we have stated, gave in its earlier days from 20 to 22 lbs. per ton of shale. Later results, however, have shown much higher proportions; and in one works at least from 75 to 76 lbs. are regularly obtained. It is well known that shale is not so valuable in nitrogen as coals are by from one-third to one-fourth; so that we may fairly say that the Young and Beilby process is fully more successful than that now worked by Mr. Mond.

PRACTICE *V.* THEORY IN CONNECTION WITH THE HEAT-PRODUCING POWER OF COAL.

There are two different methods of determining the heating value of coal. One is by burning a sample of it in an apparatus called a calorimeter, several forms of which have been devised by scientific investigators, Lewis Thompson's and F. W. Hartley's among the number. This apparatus is so devised as to collect all the heat given off, and present it in a measurable form. The other is to calculate the value according to theory, as it is generally called, although very little theory is concerned in the calculation. The material is analyzed, the heating value of the various constituents (as arrived at by the experiments of the best authorities—as Favre and Silberman) is set against each, and the sum of the whole is taken as representing the heating value of the coal.

Of these two methods, the first is the more direct. It simply calls for the proper carrying out of an experiment, with an accurately constructed instrument. If it is argued that calorimeters are not reliable, the objection applies with greater force to the second plan, which simply consists of deductions founded upon not one, but possibly several experiments with the calorimeter. It also involves several assumptions, some not unreasonable, others rather daring. We may fairly assume that the experiments of the eminent authorities who have determined the heat-producing capabilities of carbon, hydrogen, &c., have led to results sufficiently accurate for ordinary practical purposes. But are we justified in taking it for granted that, when combined together in the form of coal, the elements are simply in a state of mechanical mixture, each free to act independently of the other? The difference in physical conditions—the hydrogen and oxygen being present in a highly-condensed form as compared with the gaseous condition in which they exist under ordinary circumstances of temperature and pressure—renders it probable that they are united by stronger ties, and that in coal we have a chemical combination of some kind or another. But every kind of chemical action means either the absorption or production of heat. In simple language, it is either burning or unburning. Hydrogen and oxygen may be caused to combine, forming water; or steam may be decomposed into its elements. We do not propose to argue as to the nature of the chemical reactions concerned in the formation of coal. Attention is simply directed to the probability that it exists; and that it means some difference in the heating value when the mineral is burnt, compared with that shown by calculation.

A simple illustration of the different heat absorption caused by the decomposition of the same chemical combination under different physical circumstances, is afforded by water in its three forms of ice, water, and steam. If we seek to decompose ice into its elements, hydrogen and oxygen, about 62,650 units of heat will be absorbed per pound of ice decomposed. A pound of water may be decomposed with the absorption of 62,500 units of heat; but if the water is in a state of vapour or steam, about 61,500 units will suffice. Applying this simile to the opposite or contrary act of combustion, it is only reasonable to suppose that various combinations of carbon, hydrogen, and oxygen may give off quantities of heat varying considerably from results that may be expected according to their constitution as shown by analysis, when they are submitted to combustion. Bearing these considerations in mind, it is not surprising that sometimes the observed calorific value should exceed that arrived at by calculation, or, indeed, that the practical results obtained from a fuel with the aid of modern

regenerating apparatus, gaseous firing, &c., should also be in excess. Some few instances of such results are on record; and at first they were quietly put aside as untrustworthy and erroneous. But lately M. Scheurer-Kestner, operating on various samples of French coals, with a Favre and Silberman calorimeter, obtained in almost every case a higher result than that shown by calculation; and at a recent meeting of the Manchester Section of the Society of Chemical Industry, Mr. William Thomson read a paper giving an account of some experiments undertaken by him upon 12 different samples of English coals, out of which three of the experimental results exceeded those arrived at by calculation.

Mr. Thomson's investigations are of an interesting character, as showing the means adopted in a modern laboratory for analyzing and testing samples of coal; and as such we propose to lay them before our readers. His results are embodied in a table on p. 644. The calorimeter employed was an improvement upon that invented by Lewis Thompson; and a full description of it had previously been given to the Society by the author. The principal innovation is that, instead of mixing the sample of coal with a comparatively large quantity of chlorate and nitrate of potash, in order to ensure complete combustion, a supply of oxygen is introduced into the combustion chamber, which renders the use of extraneous material unnecessary. The combustion is started by a small wick in the first place (as in the earlier form of apparatus) and maintained by the regulated supply of oxygen until quite complete. As regards the various items in the table, the volatile matter was determined by heating about 150 grs. in a platinum crucible, with a well-fitting lid, till all volatile matter was driven off. The ash was determined by burning about 25 grs. in a muffle furnace. In testing for sulphur, 50 grs. of the coal were heated with 100 grs. of pure sodium bicarbonate, till it was almost all burned away. The mass was then fused, and a little potassium nitrate added so as to ensure the complete oxidation of the sulphur. The fused mass was next treated with filtered water, hydrochloric acid being added until the solution was freely acid, and the sulphur was then precipitated with barium chloride. For nitrogen, 50 grs. were finely powdered, mixed with soda-lime, and heated in a combustion tube, the vapours being caused to pass through standard acid. The moisture was arrived at by drying at 220° to 230° Fahr. for one hour in an air-bath. For carbon and hydrogen, 5 grs. of the dried sample were transferred to a porcelain boat and burned, first with dry air free from carbon dioxide, and then with dry oxygen also free from carbon dioxide; the gases being passed through red-hot oxide of copper, then through lead chromate, and finally to the chloride of calcium tube, and potash bulbs.

In calculating the heating value from the analysis, that of carbon was taken at 8080 units of heat, that of hydrogen at 34,462, and that of sulphur at 2220. The oxygen present was assumed to be in combination with hydrogen as water, so an equivalent of hydrogen, calculated from the oxygen present, was deducted from the total hydrogen.

The calorific results are stated in Centigrade units; and these can readily be reduced into Fahrenheit units by multiplying by 1·8. Comparing the results obtained by the calorimeter with those shown by calculation according to the analysis, we see that in No. 1 the results are fairly concordant; in Nos. 2 and 3 the calorimeter is some 6 or 7 per cent. too low; Nos. 4 and 5 agree better; No. 6 is slightly in favour of the calorimeter, but not more than might be accounted for by experimental error; in No. 7 the calorimeter is again considerably behind; in Nos. 9 and 10 it is in excess, to a greater extent in the case of No. 6; and Nos. 8, 10, and 12 are concordant.

Looking through the constituents of those samples where the calorimeter gave an excess of heat above that shown by calculation, it will be observed that these three samples also possess one other peculiarity. They contain the largest proportion of oxygen. Further, No. 9, which shows the largest excess, also contains the highest percentage of oxygen. No. 11 comes second, and No. 6 third, in both respects. This suggests the possibility that the assumption respecting the oxygen being present as water is erroneous. It certainly seems strange to suppose that a sample of coal should contain as much as 14 per cent. of water that is not driven off in the drying oven. Yet, if this assumption is correct, most of the samples retain considerably more water after drying than that actually driven off and entered in the analyses as moisture.

Underground Waters.—At the recent meeting of the British Association, Mr. C. E. De Rance submitted the fifteenth report of the Committee appointed for the purpose of investigating the circulation of underground waters in the permeable formations of England and Wales, and the quantity and character of the water supplied to various towns and districts from these formations. The Committee stated that since they were appointed at Belfast fourteen years ago, the recognition of the great value of the underground water stores had made wide progress, as affording to corporations, local boards, and public companies efficient supplies of water free from organic impurity, regular in quantity during periods of drought, yielded at a constant temperature throughout the year, and obtained, as a rule, at a smaller outlay than gravitation supplies, and almost invariably at a less cost as regards legal and parliamentary expenses. The publication of the results already obtained by the Committee has been greatly appreciated by engineers and contractors, and has undoubtedly helped and supported recommendations of water supplies from underground sources.

Notes.

The Godillot Furnace.

Much attention is being paid by engineering visitors to the Paris Exhibition to the Godillot furnaces, as applied to various kinds of boilers in the electric lighting and general machinery departments. The best illustration of M. Godillot's system is supplied in connection with the firing of Messrs. Davey, Paxman, and Co.'s range of locomotive boilers; but the principle is the same for any kind of boiler. The object aimed at is the complete, and consequently smokeless, combustion of inferior descriptions of fuel—breeze, dirty small coal, sawdust, spent tan bark, &c. The method consists in mechanically feeding the fuel, by means of a traversing screw working in a tube or trough, on to the top bar of a stepped grate, from which it drops down, step after step, being dried and if necessary partially carbonized as it goes, until it reaches a horizontal grate at the bottom, fan-shaped on plan, where the combustion is completed. In the example of the Paxman boilers, which are nine in number, the small coal fuel is caused to travel along a main supply trough, from which branch troughs lead to every furnace. Instead of being provided with the usual fire grate, the locomotive boilers stand with their empty fire-boxes immediately over the brick-built Godillot furnaces, which are on a lower level. There is nothing peculiar about these except the stepped grate, which occupies the front of the fire chamber, and is enclosed by folding doors. Every step is rounded off with a nosing on the inside, so that the whole present an inclined plane at the angle at which the fuel will most conveniently work downward. Water troughs under each keep the iron cool and prevent burning away. There is also a water trough under the bottom grate. This system has been tried with a great variety of fuels, and is reported to be very successful. It is rather remarkable that with many kinds of rubbish—including sawdust, tan, flax refuse, ramie refuse, and wet oak chips—the duty in weight of steam obtained per unit of weight of the dry fuel, is nearly equal; ranging only from 3·61 to 3·97 for sawdust and tan respectively. There are no particulars yet published of the performance of this system of furnace with breeze or small coal.

The Permeability of Cement.

A series of experiments to determine the permeability of cemen and cement mortar by water has been carried out by Messrs. G. W Hyde and W. J. Smith, of the University of Pennsylvania, U.S.A. The apparatus employed was a cylinder of 3-inch wrought-iron pipes screwed into cast-iron tees, at the lower ends of which were caps containing the specimens to be tested, the joints of which with the metal were made water-tight by means of india-rubber rings. A hand force-pump (so as to give the necessary pressure of water) and a gauge, completed the apparatus. Filtered water was used, to avoid any clogging of the pores of the samples by sediment. Pressures of 75 lbs., 100 lbs., and 200 lbs. were maintained throughout the various series. Eight samples of cement were obtained for trial; and the experiments comprised tests of neat cement after 7 days, of neat cement after 28 days, and of mortars composed of one-and-one, and one-and-two of sand respectively for the same periods. The results show that some neat cements are permeable in thicknesses of 3 inches, while others are not permeable under the same conditions. All the mortars were permeable; the amount increasing with the pressure, and decreasing with the age of the specimen, but not in any direct ratio. Large surfaces, however, are very apt to contain cracks and flaws, which greatly increase the permeability. Magnesia is an undesirable constituent, as it causes expansion and ultimate crumbling or flaking. Sulphur will destroy either stone or concrete; and some paints contain so much sulphur as to destroy concrete. It is admitted, however, that data vary very widely with regard to this matter of the permeability of cement, mortar, and concrete; the differences being ascribed to the varying size and character of the ingredients and the manner of mixing.

The Strength of Bolts.

In computing the strength of bolts in iron structures, it is undesirable to allow a stress of more than 2 to 3 tons per square inch, assuming the ultimate breaking strain of the metal of which they are made to be 20 tons per square inch. These low strains are adopted because the greatest stress to which a bolt is ordinarily subjected is that due to the tightening up of the nut, which is frequently so high that the bolt has little margin of strength left for its structural purpose. It is commonly the practice of workmen to put an unnecessary strain upon bolts in this way; and it is not a rare phenomenon to see a bolt actually torn through by the superfluous pull upon the nut when the ordinary spanner has been temporarily lengthened by the addition of more leverage, usually in the shape of a piece of iron tubing, in order to close the joint. Even when the strain upon bolts is not carried to this excess, they are often crippled by the process of tightening up to a dangerous extent, as their appearance when taken out again for any purpose indicates. It should be borne in mind that a man of average strength, working a spanner or wrench of the usual length, can exert fully as much strain upon bolts of anything under 1 inch diameter as these are qualified to bear and leave any margin of strength for their work. Fitters are too often unable to appreciate the fact that when screwing down bolts, metal to metal, there is nothing to be gained, but everything to be lost, from pinching the nut farther than is required for obtaining a solid bearing. This is one of the reasons to be considered in determining the difference between bolts and rivets in structural ironwork.

Technical Record.

SECONDARY AIR SUPPLY TO ORDINARY RETORT-SETTINGS.

By W. J. Best, of St. Ives.

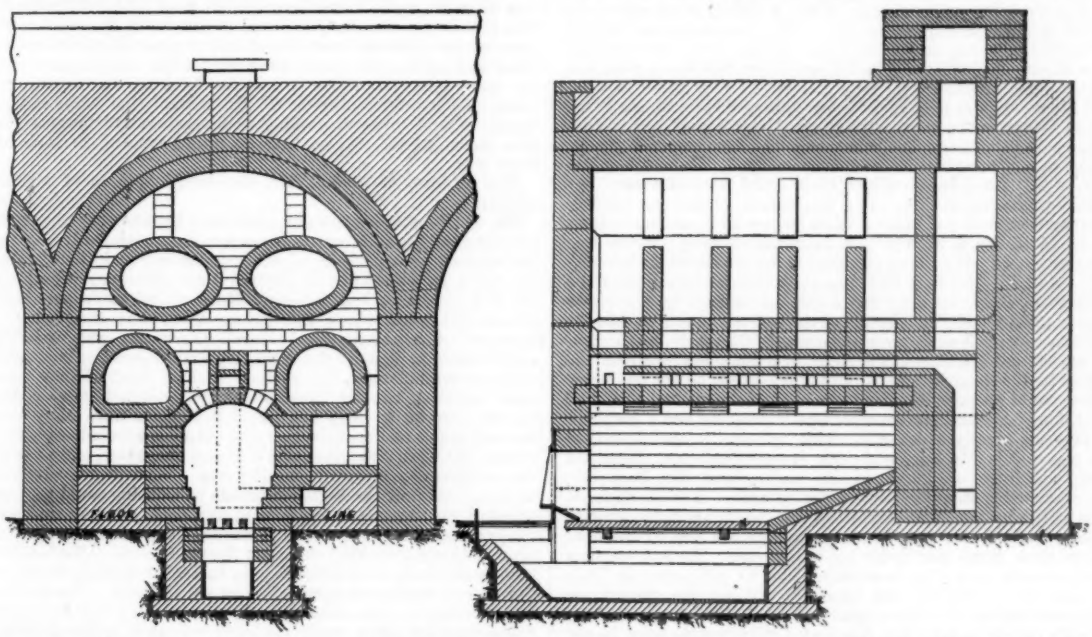
[A Paper read before the Eastern Counties Gas Managers' Association, Ipswich, Sept. 18, with the discussion thereon.]

I would most respectfully ask you to allow me to relate my experience in adapting a secondary air supply to ordinary retort-settings, which I will try to do as briefly and explicitly as I can. It has often been a source of annoyance to me, on comparing the statistics of some gas companies, to find that, after taking into consideration the quantity of coals carbonized, my fuel account is considerably in excess as compared with those companies. I am aware that, having a small works making about 7,000,000 cubic feet of gas per annum, great things cannot be expected in this direction, more especially as during the summer months, while the demand for gas is limited, the fires have to be kept up with the retorts often standing idle. Of late years a great amount of labour and attention has been expended by various companies, in the reduction of the fuel account by the adoption of regenerative furnaces; but for numerous reasons, these hardly come within the practical reach of small works, and in my own case are altogether out of the question, through the liability to floods. The only resource left open was to see what improvement could be made in the present settings.

On observation, I noticed, in the ordinary course of events, that the flame from the furnace extended not only into the main flue, but sometimes into the chimney stack, or until it found a sufficient quantity of air to complete its combustion. This was anything but a desirable state of affairs, and clearly proved that this kind of thing was a waste of both heat and fuel, and that the furnace required more air than was generally supplied through the fire-bars, so as to complete the combustion within the setting. With a view to remedy the above-named defect, I prepared a plan for the introduction of a secondary air supply to the furnace, and communicated with my retort-setters, who in reply stated that they had themselves been experimenting in this direction, and having in stock the necessary specials for this kind of setting, they suggested that I should try the same. Their system somewhat differed in detail from my own; but the object being the same, and with a view to economy and for other reasons, it was advisable to adopt their system.

In order to make all plain and intelligible, I have placed before you plans of the retort-setting now in use at St. Ives, which I will endeavour to explain. The primary air supply is admitted to the furnace in the usual way, and is regulated by a damper, the frame of which is bricked in on a level with the retort-house floor, and over the front of the ash-pit. Apart from regulating the primary air supply, this will also be found a useful arrangement while the stoker is charging the retorts, during which operation this damper may be nearly closed, which prevents any coke or coal from falling into the ash-pan, and again withdrawn to its proper position immediately after charging. The furnace is of the usual type; but in order to secure a good depth of fuel, which is an important consideration, the furnace is fitted with a frame having two doors one above the other, so as to facilitate this object. The secondary air supply is also regulated by a damper, and is admitted at the front, carried along under the flue of the bottom retort the whole length of the setting, up the back, and into the air-bricks, is further conveyed by these to the front of the setting, and on its return journey finds its exit through the port holes of the air-bricks, which are so arranged between the transverse walls as to bring the secondary air into direct contact with the gases evolving from the furnace.

I need scarcely point out to you that, from the way the secondary air is conveyed into the setting, it not only becomes highly heated, but is equally distributed throughout the whole length of the setting. This not only secures a uniform admixture of the gases, but



is also a safeguard against local heating. In order to ascertain when the relative dampers are arranged so as to prevent the flame from travelling any distance beyond the setting, it has been necessary from time to time to remove one of the coverings over the main flue. The inconvenience attending this operation induced me to have a special quarry made, with a 6-inch hole, and placed on the top of the flue in such a position as to bring the hole immediately over the damper of the setting. This is again covered with a small tile, which is at any time easy of removal. You will observe that this system of secondary air supply is applicable to any existing arch, or any form of retort-setting where a retort is not located immediately above the furnace, and does not require any flues below the floor-level, or diminish the area of any existing flues of an ordinary setting.

Having endeavoured to explain the setting before you as clearly as I can, I will now state some practical results in working with the same as compared with an ordinary retort-setting; and for this purpose I considered it would be advisable to embrace a period of time extending over six months' working, as a more reliable test than a shorter period. In order to arrive at the fuel account, after making the proper allowance from the stock of coke, the quantity sold has been taken as a basis. This showed an increased sale of coke equal to 20 per cent. in favour of the new setting; while the heats greatly improved and the charges which formerly took five hours to burn off were now better done in four hours. Apart from this, owing to the greater heats and more rapid production of gas in the retorts, the make of gas increased at the rate of 700 cubic feet per ton of coal carbonized. It was also noted that, on an average of a week's working, the production per retort was 6700 feet per 24 hours, as against 4300 feet. The size of the top retorts is 21 in. by 14 in. by 8 ft. 3 in.; of the bottom, 16 in. by 14 in. by 8 ft. 3 in. In order to accommodate the gas plant generally and to nurse the recuperative power of the furnace, some time is allowed to elapse between the charging of each retort. I need not further dilate on the merits of this setting, the results derived from the same were a sufficient reason for me to have another setting on this principle erected this summer.

In conclusion, I might state that, from the advantages secured by this setting, and its adaptability to existing arches, together with the small cost beyond the ordinary retort-setting, brings it within the practical reach of any small company, and that with satisfactory results.

Discussion.

The President remarked that he hoped every gentleman who could say anything on the subject dealt with by Mr. Best, or had an inquiry to make, would do so, as they were assembled together for the mutual advantage of each other, and for the ultimate benefit of the companies they served; and everything that tended to save coal or increase the production of gas, while it affected them as gas managers, also affected financially the companies they represented.

Mr. J. T. Jolliffe (Ipswich) said he should like to thank Mr. Best for the paper he had read, and the interesting statistics he had placed before the members. He was sorry, however, he had

not carried the idea farther. The introduction of the secondary air supply at the particular point mentioned was perhaps of some value in reducing the temperature of combustion on the furnace-bars; but beyond that he questioned very much whether the results were really beneficial. It might, he thought, have been accomplished easily—and perhaps more easily—by putting the arch of the setting a little higher up and closer to the top retorts. He did not wish Mr. Best to think he was criticizing his setting; but he thought all their efforts as engineers should be in the direction of recovering the waste heat that was passing away to the chimney. Whether or not perfect combustion took place in the chamber or furnace of the setting, the amount of heat that was going into the flue was directly proportional to the heat of the setting itself. Although perhaps something—and that a very little—was gained by the secondary air supply, their main endeavour should be to recover the enormous volume of heat that was distinct waste and loss. He would, of course, at once admit that in small works great difficulties were experienced, and in some large works, too. In his own case, he could not use regenerator furnaces, because in the retort-houses excavations could not be made, as water was found, and he could not go upwards on account of the roof of the buildings. His chief object in speaking was to suggest a plan, which he had found beneficial, of raising the whole of the steam required on the works from the waste heat of the retort-settings. His experience was that, with a boiler 30 feet in length, and 7 feet in diameter, it was possible, with the waste heat passing away from five settings of retorts (these were not extravagant settings—there were eight retorts in a bed, and the fuel account was very low), they could raise the whole of the steam that was needed on the works, not only for the exhausters and pumps, but also for the sulphate of ammonia house. Those who made sulphate knew what an enormous drain it was upon them to find the necessary fuel to make the sulphate.

Mr. J. Barton (Peterborough) said he thought they were much indebted to the author of the paper; but he was sorry that he had not given a few more details of the working, more especially in regard to the consumption of coke. The system seemed to him (Mr. Barton) to be a good one for small works, where the settings were in threes and fours; but he did not know that the saving was worth the extra expense incurred. Referring in his paper to what he had achieved, Mr. Best said that an increased sale of coke was shown in favour of the new setting equal to 20 per cent. That certainly was very good; but what was the consumption of coke previous to the introduction of these settings? Unless they had figures of this kind before them, they could not, of course, say that there was a real saving. The production of gas per mouthpiece was extra good. A make of 6700 feet per 24 hours, for retorts 21 in. by 14 in. by 8 ft. 3 in. was excellent working. There was another question. How long did these retorts remain in working order? And did Mr. Best find that, with the introduction of the secondary air, there was a cutting action on the tops of the lower retorts, or underneath the bottoms of the two top ones; or was the draught so equalized as to prevent cutting? Certainly, he thought Mr. Best had made a step in the right direction; but without the figures as to the quantity of coke used and saved, he did not know how they could properly discuss the merits of the system they had before them. At the Peterborough Gas-Works, he had a plan of a secondary air supply which was a little different to that described in the paper. His (Mr. Barton's) settings were in sevens. He could not very well introduce his air in the manner that Mr. Best did; but he admitted it on either side of the furnace. The air channel went in at the bottom, was carried to the back, then up a little way, then to the front, and then off again to the top of the fire; and there were three port-holes on either side. He had reduced his fuel account from 33 to something like 24 per cent. A little better heat was obtained; but he could not get the results per mouthpiece spoken of in the paper. He did not know how long Mr. Best's retorts lasted; but those at Peterborough were in use from 700 to 800 working days. He renewed them about once in three years.

Mr. A. Mitchell (Bury St. Edmunds) said he had had no experience of regenerative furnaces at his works, as he was placed in somewhat the same position as Mr. Jolliffe—that was, he was troubled with water under the retort-benches, and it would be exceedingly difficult to go down and put the brickwork and flues there which, he believed, were absolutely necessary for regenerative furnaces. Although he had not these furnaces at work at Bury St. Edmunds, he knew something as to their operation in large works. He must say that he felt, with Mr. Jolliffe, that they should endeavour to effect an improvement in the utilization of the heat that passed away to the chimney. There were two or three things in regenerative furnaces which they must adopt to obtain an improvement in their settings. These were: They must have deeper furnaces than they had been accustomed to; and they must fire with hot coke. In the paper that had been read, and in discussions upon regenerative systems, sufficient importance had not been attached to the advantage of firing with hot coke. If the furnaces were fed with coke that had been quenched with water and was saturated, there must be a serious waste of heat. There was another point which should be attended to. They must have deeper furnaces, and an arrangement of flues underneath the settings, so as to utilize the heat which otherwise would pass straight away to the main flue and the shaft. They must, if they were going to do any permanent good in the shape of improving the furnaces, have a depth of brickwork to enable them to have a number of flues, among which a current of heat would travel to be supplied to the furnaces. This would enable them not only to heat the air, but to conserve in the brickwork a great amount of heat which would be transmitted throughout the setting. It would be an immense gain to them to conserve and obtain the benefit of that which would be lost, as it would tend to heat up their retort-settings to a greater extent than before. He thought they were indebted to Mr. Best for his paper, as it brought before those engaged in small works, where the settings were in threes or fours or even sixes, a means of improving their furnaces. He could hardly say that he liked Mr. Best's idea of heating the secondary air supply; and he was certainly not utilizing the waste heat that went away to the chimney. At the same time, the paper gave each one something to think out in his own way; and the hints contained therein should lead them to try experiments in their respective works.

Mr. J. E. Brockway (Oakham) said the subject of the paper was an interesting one, especially to those who had the management of small works, as the system was very applicable to settings containing only three or four retorts. Seeing the extraordinary results that Mr. Best had achieved, the thought naturally came to him that, if such wonderfully good returns could be shown with a simple arrangement of this kind, those who had designed those extensive and costly regenerative furnaces, with their deep cellar-like excavations, had a long way overshot the mark. He could only say that Mr. Best would certainly shortly have at least one member from that meeting at St. Ives to critically examine the setting; and, if satisfactory, he should adopt it. He (Mr. Brockway) noticed the paper did not mention the quality of the coal that was burned off in four hours; and he should like to know what coal it was. The author also gave, as the average of a week's working, the extraordinary figure of 6700 cubic feet per mouthpiece in 24 hours. Was that the average of a week's experiment, or was it from an average week's working for an extended period—say two or three months?

Mr. A. Drage (East Dereham) said that he did not use regenerative furnaces, as he found he could not work them. His experience was that it was necessary to stand in the retort-house to regulate the secondary and primary air supplies according to the weather. They had tried at his works what Mr. Jolliffe advocated—utilizing the waste heat to heat the boiler; but by doing so, they killed the heats in the retorts altogether. He wished that some of the old members who had successfully used regenerative furnaces would give their experience; so that he might try and work his in the same way.

The President invited Mr. Goddard's opinion of Mr. Best's setting.

Mr. D. Ford Goddard (Ipswich) said he was very pleased to be present that day to hear the paper that had been read. Personally he had had no experience of these furnaces; and therefore could not speak professionally as regards their efficiency or otherwise. To him the most satisfactory feature about the paper, and the experiment with which the writer dealt, was the fact that a manager of a comparatively small gas-works was undertaking experiments in some of the most important branches in connection with gas manufacture. It seemed to him that, if they were to make much of a matter like this, they must not leave it simply to large works to carry out the trials. There were many circumstances which rendered the carrying out of experiments easy in large works, but were altogether of a different character, and unsuited to the conditions met with in small works. What they really wanted to know was how the higher methods of working could be adapted to small works; and he rejoiced to find that younger members of the profession in charge of such works, were taking up these questions, and were working them out for themselves. Nothing would tend so much to their advantage as to deal with these things under the special conditions in which they were placed. The conclusion he had come to was that the experiment had not been carried sufficiently far; that really the point indicated by Mr. Jolliffe was just what was omitted in this experiment—viz., the utilization of the waste heat from the flues, and that which passed away by the chimney. Of course, one could easily understand that, to deal with a complete regenerative system (which he did not understand Mr. Best's was) necessitated in the first place some considerable experience, and in the second place a large outlay—which were not often met with in small works; and thus they must not look for an exhaustive experiment in such works on complete regenerative systems. However, those who had the management of small works could apply the principles which had been used in larger works, to the benefit of their undertakings. He noticed that one of the advantages said to be gained was that the charges, which formerly took five hours to burn off, were better done in four hours. For himself he could not see that anything was to be gained by burning off a charge in a quicker time. He had tried numerous experiments in former years, with a view of getting rid of the charges as soon as possible; but they had always ended in some kind of difficulty. The principal trouble arising from rapid carbonization, he found, was the stopping up of the ascension-pipes. He did not know whether Mr. Best had had any experience with this unpleasant occurrence in the retort-house; but he was afraid, that, if his experiment had continued for a length of time, and he had tried to work off full charges in four hours, he would sooner or later have met with the difficulty, which would quickly run away with the good results that might otherwise be obtained. It was almost beyond calculation what amount of loss there was when the trouble of choked ascension-pipes overtook a manager—there was the waste of fuel and retort power, as well as retorts. This struck him

Mr. Goddard) as one of the points Mr. Best had not touched upon. Perhaps he had been able to overcome the difficulty. He should like to know how long the experiment had been tried—whether the setting had been fairly tested, or whether the results were obtained from a set experiment in a given duration of time.

The PRESIDENT noticed Mr. Helps was present; and said he would like to hear his opinion of Mr. Best's setting.

Mr. J. W. HELPS (Croydon) was much obliged to the President for calling upon him. He, however, laboured under many difficulties—one of which was speaking on a paper he had not heard read. And he might remark that he had had little or no experience with regenerative furnaces. At Croydon all their retorts were fitted up on the old principle, with seven retorts in a setting. They were prevented from adopting the regenerative system by the presence of water very near to the surface of the ground. He was much struck by a remark made by his old friend Mr. Goddard, when he said that he was particularly pleased to find managers of small works taking up the investigation of such matters as this themselves—matters practically based on theory and scientific principles. There was a great deal of truth in what Mr. Goddard said—that it was almost impossible for managers of small works to learn very much from experiments made in large works; and therefore it was very pleasing to see that a manager of a small undertaking could get up a paper of this description, and give his experience of the working of a setting of this character. He also concurred in what Mr. Goddard said, as to the effect of forcing the charges. Of course, the time needed to work off a charge depended to a great extent on the quality of the coal. If managers tried to get a certain amount of gas out of any coal, and forced the carbonization, they were almost certain to fall into a difficulty, and have a great deal of trouble with stopped ascension-pipes. This was a very important point, and should not be lost sight of. An experiment which only had for its object the production of a certain quantity of gas in a given time, could not be called a success.

The PRESIDENT said he thought they were all satisfied with the discussion that had been raised. There were two or three remarks he wished to make; and the first was that not one of the speakers had hit the right nail on the head. Mr. Best told them in the paper that he burnt off his coal in four hours instead of five hours; and that he obtained 6700 cubic feet of gas per mouthpiece in 24 hours from comparatively small retorts. But Mr. Best had failed to tell them the illuminating power of the gas evolved in five hours, and that emitted in four hours. As to what had been said about stopped ascension-pipes, he did not care a fig. Gas managers could work at what heat they liked; if they would only adapt the ascension-pipes to the purpose for which they were intended, they would have no stopped pipes. He was very much amused when he saw papers that had been read on this subject. At Grantham, he believed he worked with as high heats as any gentleman in the profession; and he had done so now for fifteen years, and had not had fifteen stopped pipes during that period. He thought that there must be a huge and serious blunder somewhere when pipes were continually being stopped. Mr. Jolliffe certainly began the discussion in an admirable way, and showed the grasp that he had of the contents of the paper; but he (the President) might be permitted to say that what Mr. Best had brought forward was not a regenerative system of heating furnaces at all. It was, as the paper stated, a plan of heating furnaces by secondary air brought in at the top. As one gentleman remarked—he believed it was Mr. Goddard—a setting of retorts was very expensive on the regenerative system. Some of them knew what other works had had to pay for them, and had not benefited very much by them. He considered it wise to wait a little before doing anything with regenerative furnaces. With regard to this idea of Mr. Best's, he (the President) believed there was something in it, and that the author had not got all out of it yet. He should watch Mr. Best more than a week; and should want to know how he had progressed at the end of three months. He remembered some few years ago, when in Scotland, calling upon Mr. Watson, of Stirling, who had a very easy way of introducing secondary air into his retort-settings, and had accomplished very great things. He had simply a ¾ or 1 inch pipe (he was not certain which) introduced in the front of the bed. On it he had a stopcock, so that he could regulate the supply of air into the settings in a very admirable way. If Mr. Watson accomplished all he said he did, he did it at a very little cost to his company, and but little trouble to himself. He (the President) thought the paper would be of great use to every one of the members; and he complimented Mr. Best upon his production, though he did not agree with everything that was said in it.

Mr. BEST, in replying upon the discussion, said he quite agreed with Mr. Jolliffe that it was advantageous to get back some of the waste heat from the flues. He hoped in the near future to be building a new retort-house; and he intended doing something in this direction. In answer to Mr. Barton, he said he found no more cutting action or wear and tear than in the ordinary settings. The principal disadvantage he laboured under was the narrowness of the arch. It was something like 5 ft. 10 in.; and he could only work the furnace for a little while—say, four months—before he had to let the setting down, in order to re-line the furnace. Respecting the introduction of the secondary air supply, his paper showed that he obtained better heats, and that there was a saving of fuel. He endorsed the opinion of Mr. Mitchell as to firing with hot coke. Mr. Brockway asked about the make of gas per mouthpiece—whether or not the results were produced by a set experiment. He had worked this system for two years; and had not limited himself to any particular week. One week he found he made 186,000 cubic feet; and this worked out to 6700 cubic feet per mouthpiece per day. The following week, he made 184,000 cubic feet; and the next week, 182,000. These diminished returns resulted from the demand for gas not being so great, and therefore they did not require to manufacture so much. He experienced no difficulty whatever in making 186,000 cubic feet per week; and the charges were completely burned off. As to Mr. Goddard's remarks in regard to blocked pipes, he was correct in saying that by working at high heats these inconveniences did result. He did not think there was a gentleman present who had been annoyed more than he had in this respect. But he was pleased to say that stopped pipes very seldom occurred now at his works. He had adopted a plan suggested by Mr. Crowe, by which a little cold water was allowed to trickle down the pipes; and it had proved a cure in his case. As to Mr. Helps's question regarding the quality of his raw material, he used Aldwarke Main coal. Respecting the President's observations, he thought it would be understood from the paper that the object of introducing the secondary air supply was to prevent the flame of the furnace going into the main flue. He was led to think that the furnace wanted more air to complete the combustion in the setting; and he found he was correct, and obtained a greater amount of heat. In working with the old class of setting, when he enlarged the damper-way, in order to have a better heat, a larger flame went up the flue; and the retorts did not get any hotter. When making 186,000 cubic feet per week, and working four-hour charges, with his present settings, he had never seen a retort that was not thoroughly exhausted. One gentleman asked about the illuminating power of the gas. He (Mr. Best) employed a jet photometer; and it was in constant use. The stoker had strict injunctions to see that it did not indicate under 16 candles. They kept the jet pretty steady, by charging the retorts alternately; the manufacture of gas being then continuous. The extra cost of a setting like his was very small; so that it came within the means of the smallest companies.

IRON AND STEEL INSTITUTE.

The Autumn Meeting of the above Institute was held in Paris on Tuesday and Wednesday last week, under the presidency of Sir J. Kitson. The proceedings were opened on the first-named day with a hearty reception by the members of the Society for the Encouragement of National Industry (in whose hall the business was transacted) and the Society of Civil Engineers. M. Eiffel, on behalf of the last-named Society, expressed his pleasure at receiving the Institute in France; and he said his colleagues desired, by the heartiness of their welcome, to show the esteem in which they held English engineers. M. Haton de la Goupillière (President of the Société d'Encouragement) followed with a few words of welcome, which were acknowledged by the President, who proceeded to deliver his Inaugural Address. At the outset he remarked that at the last meeting of the Institute in Paris, in 1878, they had 900 members; now they had a total membership of 1480. He passed on to notice the advance made since that date in the two industries with which the Institute is identified; and concluded by claiming for the members the credit of having rendered great service to the material progress of the world. The Secretary (Mr. J. S. Jeans) then read the minutes of the last meeting. These having been adopted, Professor Jordan, of Paris, read some notes on iron and steel manufacture, as illustrated by the French exhibits in the great building in the Champ de Mars; dwelling especially on the important progress made in recent years in forging, tempering, and annealing steel, especially in large pieces. The subject of constructing a bridge across the English Channel was next introduced, in a paper by Mr. Jeans and Mr. Percy Gilchrist; and it necessarily excited considerable interest. This was followed by a paper on "Gaseous Fuel," with special reference to that form of it known as water gas. The full text of this paper will be given in an early issue. Its reading gave rise to a long discussion, in which Mr. John Head (of Messrs. Siemens and Co.), M. Kupelwieser (Manager of Baron Rothschild's works in Austria), Mr. Wildy (Engineer of the Leeds Forge), Mr. Emerson Dowson, Mr. B. Loomis, and others, took part. The discussion had not concluded when the proceedings closed for the day. The members then paid a visit to the Exhibition; and in the evening were entertained by the Society of Engineers. On the following morning the discussion of Sir Lowthian Bell's paper was resumed by Mr. Samson Fox, and continued by M. Kupelwieser, Sir F. Abel (President-Elect of the British Association), M. Pourcel, and Mr. Frederic Siemens, and brought to a close by the President with a remark to the effect that, although the subject before them was of sufficient interest to engage their attention all the morning, no more time could be devoted to it. Sir Lowthian Bell having replied, the President made a few remarks on the general question. Papers on "Electric Welding" and "Alloys in Silicon" were then read and discussed; after which Mr. J. Head read a paper written by himself, in conjunction with M. Pouff, describing a new form of Siemens furnace, arranged to recover waste gases as well as waste heat. In the evening the President entertained the Council of the Institute and several guests (including M. Eiffel) at dinner. On the following morning the members visited the Eiffel Tower under the guidance of its constructor; and, at the invitation of the French Society of Engineers, partook of luncheon on the first stage. The members left Paris in the evening by special train for St. Etienne and Creuzot.

SOME ANALYSES OF COALS.—For Explanation, *see p.* 639.

—	Nixon's Navigation Collieries, Glam.	Thakerley Collieries, Tyldesley.	Tyldesley Coal Co.	Upper Drumgray Seam.			Bickershaw Collieries, Leigh, near Manchester.					A. Knowles & Co.'s Colliery.
				Bottom Part.	Hard Mid-rib.	Top Part.	Bickershaw. Main.	Pemberton. 5 ft.	Crombourke.	Wigan. 4 ft.	Bickershaw. 7 ft.	Pendleton. 4 ft.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Volatile matter	11·722	30·103	32·085	25·633	24·264	27·553	29·809	32·287	31·666	28·314	31·228	28·527
Fixed carbon	84·046	50·276	57·755	65·037	60·899	64·629	63·870	56·464	57·871	64·099	61·212	65·661
Ash	3·216	14·902	4·086	6·549	12·576	4·286	1·961	4·550	3·313	2·749	·960	1·912
Moisture	1·016	4·719	6·074	2·781	2·261	3·532	4·360	6·699	7·150	4·838	6·600	3·900
	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000
Coke	87·262	65·178	61·841	71·586	73·475	68·915	65·831	61·014	61·184	66·848	62·172	67·573
Total sulphur	·787	1·619	·646	·749	·543	·862	1·066	1·021	1·449	1·238	·699	·629
Fixed sulphur	·098	·230	·154	Absent	Absent	Absent	·025	·089	·283	·171	·018	·040
Carbon	88·029	68·134	74·464	75·484	72·130	75·049	78·930	72·409	69·774	76·487	73·913	79·760
Hydrogen	4·112	4·777	5·105	4·982	4·672	5·123	4·904	5·158	4·819	4·964	4·858	4·893
Oxygen	1·977	4·861	5·251	7·865	6·565	9·391	7·239	8·844	12·445	8·458	11·320	7·517
Nitrogen	·961	1·218	1·528	1·590	1·253	1·757	1·565	1·408	1·333	1·437	1·668	1·429
Sulphur	·689	1·389	·492	·749	·543	·862	1·041	·932	1·166	1·067	·681	·589
Ash	3·216	14·902	4·086	6·549	12·576	4·286	1·961	4·550	3·313	2·749	·960	1·912
Moisture	1·016	4·719	6·074	2·781	2·261	3·532	4·360	6·699	7·150	4·838	6·600	3·900
	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000
Total organic matter	95·079	78·990	89·348	89·921	84·620	91·320	92·638	87·819	88·371	91·346	91·759	93·599
Which is composed of—												
Carbon	92·585	86·257	83·342	83·945	85·240	82·182	85·203	82·453	78·956	83·733	80·551	85·215
Hydrogen	4·325	6·047	5·713	5·541	5·521	5·610	5·294	5·873	5·453	5·434	5·294	5·227
Nitrogen	1·011	1·542	1·710	1·768	1·481	1·924	1·689	1·603	1·508	1·574	1·818	1·527
Oxygen	2·079	6·154	9·235	8·746	7·758	10·284	7·814	10·071	14·083	9·259	12·337	8·031
	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000	100·000
Calorific power—												
Found by experiment	8,340	6,448	7,069	7,384	6,954	7,533	7,465	7,242	7,456	7,552	7,417	7,736
Calculated	8,459	6,972	7,430	7,493	7,166	7,443	7,778	7,267	6,787	7,549	7,176	7,819

WATER GAS IN THE UNITED STATES.

One of the papers presented to the Mechanical Science Section at the recent meeting of the British Association in Newcastle-upon-Tyne was on the above subject; the author being Mr. A. C. Humphreys, of Philadelphia.

Mr. Humphreys commenced by explaining that water gas is generally procured by the decomposition of steam which has been brought into contact with incandescent carbon; the first reaction obtained being the formation of carbonic acid and the liberation of hydrogen. The carbonic acid is brought into contact with an additional quantity of incandescent carbon, from which it takes up an equivalent, and becomes carbonic oxide; so that there results, theoretically, a mixture of hydrogen and carbonic oxide in equal volumes. These gases have no light-giving properties; so that if they are to be used for illuminating purposes, they have either to be mixed with some hydrocarbon in the gaseous form, or they must be employed to raise to a white heat some solid substance—such as lime, magnesia, &c. There are two ways of effecting the decomposition of steam—one intermittent, the other continuous. In the first a furnace of the cupola pattern is used; and the fuel is raised to the desired temperature by a blast of air, which is shut off as soon as this is attained, and steam is turned on; the blowing up and the injection of steam succeeding one another intermittently. In the continuous process the decomposing carbon is either placed in retorts heated externally, and steam passed through uninterruptedly, or a cupola furnace is employed, and steam and air are forced in continuously; but the latter process has the disadvantage of the resultant gases being associated with a great deal of nitrogen, so that after enrichment with hydrocarbons the flame is "tender," is easily blown out, and smokes on small provocation.

According to Mr. Humphreys, one Fontana first proposed the manufacture of water gas in 1780; and he traced the history of the invention through its successive stages of improvement to the present day. He enumerated the large number of patents (which amount in the aggregate to 100) that have been taken out since 1823, and summarized the merits and defects of each; closing his sketch by alluding to the battles which have been fought in the United States between the coal-gas and the water-gas interests—the question of the danger of the latter being the main point at issue. The professional papers ranged themselves on opposite sides, and Courts of Law had to decide between the conflicting evidence of experts. The old Boston Gas Company succeeded in obtaining the passage of a law prohibiting, in the State of Massachusetts, the manufacture and sale of gas containing more than 10 per cent. of carbonic oxide. This rendered it impossible to manufacture water gas economically. Litigation of an energetic character went on for years, and, indeed, is still raging, though 223 Boston doctors have signed their names to a declaration "that water gas is no more dangerous to health and life than coal gas; and there is no just ground, as far as health and life are concerned, to prohibit its manufacture." This opinion, said the author, had been endorsed by numerous chemists of eminence, both in the United States and in Europe.

In 1874 there was practically no water gas made in the United States or in Canada. It is estimated that at the present day, out of 1150 gas-works, 300 are on the water-gas system. With the quantity of gas produced, the quality has improved greatly; so that, in the author's opinion, there is now probably no gas better adapted for distribution in extremely cold climates than water gas made in modern plant of certain construction, and that, too, from ordinary furnace coal, gas coke, and crude oil.

Mr. Humphreys next proceeded to consider the theory of the process in detail, and calculated the distribution of heat throughout the reactions; remarking that it is only by the application of the water-gas system of manufacture that the whole of the carbon used can be converted into gas.

The following details form parts of most of the plants constructed on the intermittent system:—An upright furnace of the cupola type is used both for combustion and for gasification. This is called the "generator," or "gasogene," to supply which steam is generated in an independent boiler, and the steam is sometimes superheated either by the fire of the regenerator, or by waste heat. In one class of apparatus the generator is provided with two outlets, one of which is connected to the chimney, and the other to the wash-box, or hydraulic seal; both outlets being controlled by valves. In another class the generator is connected to a separate superheater, or fixing chamber, which is provided with the two outlets, as already described. The fixing chamber is filled with refractory material, and is intended to store up heat during the "blows," which heat is to be used in the "run" for fixing or rendering permanent the hydrocarbon gases added to the water gas. In both cases the gas is condensed, scrubbed, purified, and measured in the same way as ordinary coal gas.

The author then described the various processes for making water gas. Although our readers must be tolerably familiar with them, it may be of interest, in view of the prominence into which this matter has lately been brought, to briefly recapitulate them.

In the Tessié-du-Motay process the products of combustion and heat during the blows are lost up the chimney. The water gas goes to a crude-gas holder, from which it is passed to the carburetters, consisting of a number of shallow pans, containing naphtha, over the surface of which the gas passes; the temperature being carefully regulated. The mechanical mixture of gas and naphtha vapour is then fixed by being passed through retorts arranged in benches, and sometimes fitted with bafflers.

The Wilkinson process is similar to the one just described. The

chief point of difference is the admission of steam to the generator alternately upwards and downwards through the fuel; the object being to prevent that near the grate-bars from becoming too dead, and so escaping conversion.

The Jermanovski system is similar to the Wilkinson, but a fixing chamber, filled with limestone, is added; and it is claimed that some benefit is derived from the arrangement, though the author had not been able to determine what it is, except that a certain amount of carburetting is done in it.

In the Meeze process the water gas is also made independently, but the carburetting is performed in clay retorts, fitted with an internal perforated iron pipe, through which the oil and gas enter; or the author believes that the oil only is now admitted, and its vapour afterwards mixes with the gas in the hydraulic main.

The Lowe process is typical of the generator-superheater class, and its value may be judged from the number of patents that have been grafted on it, mostly with a view to evasion; but a recent judicial decision has thoroughly established the rights of the original inventor.

The Granger-Collins process originated directly in the Lowe, where the generator and superheater were connected by an iron pipe, which acted ingeniously as a cooler. Messrs. Granger and Co. shortened this connection, and lined it with fire-brick; but finally suppressed it altogether by making the superheater partly overlap the generator, and thus secured direct communication without sacrificing the facilities of stoking from above. The oil also was introduced by an injector or sprayer, so that it met the water gas coming over from the regenerator.

The Springer apparatus, constructed by the National Gas, Light, and Fuel Company, of Chicago, encloses the generator and superheater in one shell; the two chambers being separated by a fire-brick arch, and the fuel being introduced into the lower one by lateral furnace doors. The combined generator and superheater attains to a very large size—more than 12 feet diameter by 50 feet high, with a producing capacity of something like a million cubic feet per 24 hours. In this plant the steam can also be passed up or down through the fuel; and the oil is introduced either at the bottom or the top of the superheater, by means of a steam injector. The M'Kay-Critchlow apparatus is similar to the Springer, but is especially designed for use with natural gas, which is introduced under the grate-bars with the steam. It becomes split up and carburets the manufactured gas.

The Flannery and the Hanlon-Teadley apparatus do not differ essentially from the types which have been described already; and it is doubtful whether the alleged improvements have any substantial advantages. The last named has been introduced into Philadelphia on a very large scale, and professes to supply gas at the rate of 37c. per 1000 cubic feet.

The Lowe process is now in the hands of the United Gas Improvement Company of Philadelphia, who are the largest manufacturers and owners of gas plant in the States. The apparatus has undergone many modifications at the hands of licensees; especial attention being directed to the manner of supplying the oil, which has increased in importance since the serious rise in the price of naphtha has driven the gas makers to resort to crude oil. The United Gas Improvement Company now always heat the oil before introducing it into the generator; and this is done by preference at the expense of the waste heat in the gas passing from the superheater. Mr. Humphreys devoted considerable space to discussing the details of working, and pointed out very clearly what are the conditions to be observed in order to ensure the most advantageous results. Tables were given, showing the chemical composition of the gas, as well as its thermal and physical properties; and a great deal of information was afforded as to the cost of production both in materials and labour.

By the Evans process the coke from ordinary coal-gas retorts is raked by hand into a generator set underneath, and converted into water gas by the usual method, but without being carburetted.

By the Loomis process bituminous coal is treated directly in a generator; the air for combustion being drawn down through the fuel instead of being driven up. Two kinds of gas are produced and stored separately—ordinary producer gas during the ignition period, then water gas and hydrocarbon vapours given off during the gas-making period.

A new process, patented by Mr. Walton Clark, is in course of trial by the United Gas Improvement Company. Bituminous coal is charged by gravity into inclined retorts, which are heated by the combustion of the blast gases from the generators in which the water gas is made. The coke, after distillation, falls by gravity into the generator, where it is subjected alternately to an air-blast and to steam. When the air-blast is on, the products of combustion pass through a flue into the retort-benches, where they are burned, and provide the heat necessary to distil the coal. When steam is injected into the generator, the water gas produced passes through the retorts, and so to the hydraulic main. There being two generators and two retort-settings in the system, there is a continuous flow of producer gas to the ovens and of water gas into the mains. The two benches of retorts are expected to yield per 24 hours 400,000 cubic feet of gas, with a calorific value of from 400 to 450 units per cubic foot; and it is thought that 45,000 cubic feet to the ton of coal will be obtained. This practically non-luminous gas can be carburetted at the cost of from 3¼ to 3¾ gallons of low-grade oil per 1000 cubic feet.

The author closed his paper by pointing out the importance of the Walton Clark system to this country; inasmuch as it enables soft bituminous coal to be used instead of anthracite, which is found only in small quantities here. He concluded by saying that it might not be amiss to give expression to the belief that the day of gas—fuel gas—is rapidly approaching; and fuel gas must mean, in part, water gas. Even the great rival of gas, the electric light, might yet be dependent upon it for the cheapest means of producing the electric current. Then would the gas engineer and the electrical engineer, shoulder to shoulder, be striving to correct the present wasteful strains upon Nature's storehouses.

Register of Patents.

GENERATING ILLUMINATING GAS AND GASEOUS FUEL.—Langberg, O., of Brooklyn, U.S.A. No. 13,050; Sept. 10, 1888. [1s. 1d.]

This invention relates to the combination of apparatus for generating illuminating gas and gaseous fuel for heating, generating steam, smelting metals, ores, and like purposes; and (generally stated) consists in the combination with a closed fire-box, which forms a retort chamber, of a series of connected retorts or generating chambers. The grate (which is of peculiar construction) forms a chamber, into which one or more of the generating retorts deliver, and wherein the gas intermingles with the air to support combustion, from whence the mixed air and gas is delivered for consumption as gaseous fuel for heating the retort chamber; the surplus forming a supply of gas for illuminating or fuel purposes.

The preferred construction and arrangement of the device consists of a closed chamber, or one which can be closed so as to prevent the direct admission of the external air, and which is preferably provided with an arch for confining the gases until combustion is complete, and also for storing heat and deflecting it among the generating retorts. Within this generating chamber are placed distinct sets or "nests" of retorts, pipes, or tubes, connected by either a series of return bends or elbows, or both, or tees, or unions. Each "nest" forms a continuous generating chamber. These pipes or tubes may be 2-inch pipes, or larger if desired; and all except the last one or two of each series, or "nest," are provided in the interior with a series of conical deflectors, having serrated or perforated bases, and arranged at short intervals with their apices towards the current, so as to break up and intermingle the gases, &c., in the retorts, and to force the gases to pass in contact with the walls. These deflectors or cones may be separated by spacing sleeves, and supported on a central rod.

The receiving end of each "nest" is closed by a head, through which projects a steam injector, the jet of which is connected with a steam superheater, and the oil supply communicates with the injector by means of a pipe, having a valve with which to regulate the supply. As a supply of steam is essential to start as well as to maintain the operation of these devices, a separate steam generator must be provided, in case the devices are used with other than boiler furnaces.

The inventor claims that he has designed a way of constructing and building within a closed fire chamber one or more "nests" of retorts in a smaller space, and consequently at much saving of expense and room, than has heretofore been devised. Also that, by placing the retorts entirely within the chamber, he overcomes great wear upon the materials, a saving in fuel, and a production of a higher quality of gas from superheated steam and oil than has heretofore been obtained. Hitherto, he remarks, the bends connecting the retorts have been constructed beyond or outside the walls of the chamber; thus creating unequal expansion of the retorts and their joinings, loss of fuel from the projecting bends, cooling off, and impoverished gas. By his improvements the retorts, pipes, tubes, &c., and connecting elbows, tees, &c., which form the "nests" of retorts in which gas is generated, are kept at the same even heat from the receiving to the delivery ends. There is thus no unequal expansion of metals, so as to cause rapid decay, leaky joints, &c.; and the gas generated is of even and richer quality.

GAS-ENGINES.—Simon, R., of Nottingham. No. 16,183; Nov. 8, 1888. [6d.]

This invention relates to an arrangement of gas-engine in which the cylinder is formed of two diameters, a piston of two diameters therein; the heads of the two diameters of the cylinder being connected by a pipe in its passage, through which the explosive charge is compressed to the smaller diameter end of the cylinder. The firing takes place in the pipe; and the power resulting from it is exerted on the smaller end of the piston, so as to effect the out or power stroke, while at the same time a new charge of gas and air is drawn into the larger diameter of the cylinder.

Fig. 1.

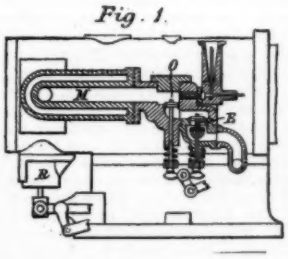


Fig. 2.

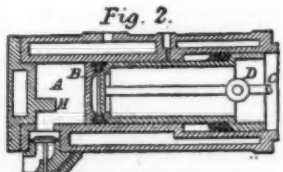
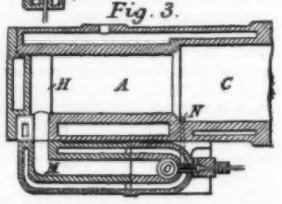


Fig. 3.



Figs. 1 and 2 are vertical, and fig. 3 a horizontal section of portions of the engine.

A is the explosion cylinder, in which works the piston head B of the double-headed piston B D. The head D works in the cylinder C.

When the piston makes its out-stroke, a mixture of gas and air is aspired through the port and the double valve shown in fig. 1; and on the instroke, the valve having been closed, the contents of C are forced into the explosion cylinder A, which still contains the waste products of the previous explosion. By means of the pressure of the new mixture coming through the piston-pipe, these are expelled through the exhaust-valve; the shelf or division wall H (figs. 2 and 3) in the cylinder A preventing the new mixture of gas and air mingling with waste products. When these latter have been expelled, the exhaust-valve is closed; and the completed instroke of the piston compresses the new mixture at the back of the piston-head B. At the outstroke, this compressed mixture is ignited, preferably by tube-firing, as shown in the drawings; and the force of the resulting explosion impels the piston outwards—a fresh charge being at the same time drawn into C as before. The return-stroke is caused by the fly-wheel. The several valves are closed by springs and opened by levers so contrived that one valve is opened a certain time before the other ones, so that "back explosions" are prevented.

Gas Motor Engines.—Taylor, J., of Nottingham. No. 708; Jan. 15, 1889. [8d.]

The object of this invention is to obtain, by simple means, an impulse or working stroke at each revolution of a gas-engine, when in full work.

To effect this purpose, two cylinders are arranged preferably side by side, each fitted with a piston and connecting-rod, actuating a crank-shaft with two cranks—one placed at an angle of 65°, or thereabouts, in advance of the other. One of these cylinders is for drawing in, mixing, and compressing the charge of gas and air; and the other for obtaining power by the ignition of the charge. To the end of these cylinders farthest away from the crank-shaft, a strong casting, containing the distributing valves, and an exploding chamber is attached, which latter forms the end of, and is a prolongation of, the working cylinder. In this breech end are fitted three or more cylindrical flanged valve seatings, each carrying a mushroom or other shaped valve, fitted with a stalk working in guides. Each stalk is provided at its outer end with a collar, between which and the outer guide a spiral spring on the stalk is compressed every time the valve is raised from its seating. This ensures the return of the valve to its seating at each revolution of the engine. One of these valves is for the admission of gas to the air-valve or air-passage; the second valve, for the admission of the mixture of gas and air to the compressing cylinder; and the third valve, for the admission of the compressed charge from the compressing cylinder to the exploding chamber of the working cylinder by suitable ports. All these valves preferably open one way, and are silent in operation.

The operation of the engine is as follows:—On the first outward stroke of the compressing piston towards the crank-shaft, on turning the fly-wheel, a mixture of gas and air is drawn past the gas and air valves into the compressing cylinder, during the whole outward stroke; and at its termination the gas and air valves are automatically closed by the lever. On the return of the piston, this charge is compressed to the necessary density, and forced past the admission-valve into the exploding chamber of the working cylinder, where it is fired by any suitable means. The effect of the ignition of the charge is to propel outwards the piston of the working cylinder; and thus make a working stroke of the engine, until the piston, near the termination of its stroke, uncovers an exhaust port formed in the working cylinder within one-eighth of the stroke (or thereabouts) of the outer end of the stroke of the piston, which it uncovers and covers during its travel. The products of combustion, being under pressure, escape rapidly through the exhaust port, until they are reduced to about the atmospheric pressure in the cylinder. At this moment, owing to the angular advance of the crank of the compressing cylinder, the charge of gas and air from this latter is being forced past the admission-valve into the exploding chamber, where it drives the products of combustion before it and out of the exhaust port, until all, or nearly all, the products of combustion are expelled through the exhaust port, by the time that this is covered again by the piston on its return stroke. After the exhaust port is covered, and during the remainder of the return stroke, this piston drives back the mixture of gas and air into the exploding chamber, and compresses it to the requisite density, ready for ignition at the commencement of another outward stroke. The gas-valve is opened and closed by suitable means from the air-valve, or from the lever opening the latter; and the connection between the two valves is made to, and controlled by, the engine governors in such a manner that, when the engine exceeds its normal speed, the communication between the two valves is broken, and the gas-valve remains closed until the engine again resumes its normal speed.

Portable Gas Manufacturing Apparatus.—Yarrington, P., and M'Donald, D. S., of Boston, Mass., U.S.A. No. 4969; March 21, 1889. [8d.]

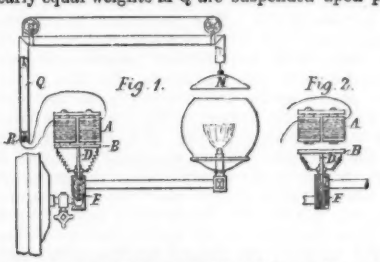
This invention relates to portable apparatus for manufacturing illuminating gas, specially adapted for use on railway cars and similar places; and it consists of a metallic tank, having an annular gutter near its upper edge; the outer wall of the gutter extending slightly above the edge of the tank. The cover is provided with an annular flange, which rests on the upper edge of the body, and tightly closes it. Resting on legs in the bottom of the body, there is a metallic gas-reservoir; a thick wooden plate being disposed on the top of this reservoir. A dome or inverted gasholder is supported by legs resting on this wooden plate. On the outer side of the dome in its upper portions are formed a series of downwardly inclined annular flanges, which serve as guards to prevent the liquid surrounding the dome from rising when the apparatus is subject to sudden shocks. The dome is held in position by rods secured thereto and to the body. A vertically-arranged pipe projects centrally through the wooden plate and reservoir top, having a flaring mouth opening under the top of the dome. When in use, the reservoir is filled with naphtha, gasoline, or similar carbonaceous material; and iron scraps and marble dust or other gas-generating substance is disposed in the perforated pan. The dome is then placed in position; and the tank filled with a weak solution of sulphuric acid and water below the flanges. The acid solution passing through the perforations in the pan acts upon the iron therein, and generates hydrogen and carbonic acid gas, which pass into the reservoir, where they come into contact with the carburetting substance therein, and receive their illuminating properties, and may then be withdrawn for use. By employing the thick wooden guard mentioned above, the reservoir is protected from accidental perforation, which would permit the acid solution to come in contact with the carbonaceous material.

Valve-Motion for Gas-Engines.—Banki, D., and Csonka, J., of Budapest, Hungary. No. 6296; April 12, 1889. [8d.]

The purpose of this invention is to dispense with cog-wheel gearing with four-measure gas motors, and to better provide for the regulation of the speed, so as to permit a more equal motion of the engine than with known valve-motions with two-measure gear. The valve-motion can be adapted to puppet valves, slides, cocks, clock-valves, &c., in all cases in which they are to be opened once after each two revolutions of the crank-shaft. The invention consists mainly in providing a reciprocating rod to be moved once to-and-fro at each revolution of the crank, shaft, and arranged in such a manner that the valve-slide, &c., is opened at one forward motion, but remains untouched at the subsequent forward motion.

Extinguishing Gas Lamps and Burners.—Steinhilber, A., of New York. No. 9968; June 18, 1889. [6d.]

In carrying out this invention—which relates to apparatus for cutting off the supply of gas to a gas-burner as soon as the flame is extinguished—the burner and connections used are of any ordinary kind; but in the conducting tube through which flows the supply of gas, a cock is placed having a key F, connected by an upwardly projecting stem D to the armature B of an electro-magnet A, so that when the magnet is energized, it will, by attracting the armature and moving the key, open the cock. When, however, the magnet is not energized, springs attached to the armature draw it the other way, and so close the cock and shut off the flow of gas. In order to automatically break and close the circuit at the proper times, two nearly equal weights M Q are suspended upon pulleys, by a



connecting cord; one weight hanging directly over the gas-flame, and the other over the connection device for closing the circuit of the battery. The weight over the flame should be slightly the heavier of the two. When the flame is lighted, the currents of hot air flowing up from the flame against this weight will bear it up a little, so that the opposing weight will press down on the circuit closer R; and the magnet being thus energized, drawing its armature, holds the cock open so that the gas can flow freely to the burner. But when the flame is extinguished, the weight over it sinks down; the opposing weight is lifted off the circuit closer; the circuit is broken; the magnet ceases to act; the armature is drawn down by the springs; the cock is closed; and the supply of gas is shut off.

APPLICATIONS FOR LETTERS PATENT.

14,287.—Morse, M. A., "Improvements relating to the manufacture of gas, and to apparatus therefor." Sept. 10.

14,291.—Pitt, S., "Apparatus for the manufacture of gas." A communication from C. B. Harris. Sept. 10.

14,312.—Valon, W. A. M'I., "Improvements in stop indices for prepayment gas-meters." Sept. 11.

14,378.—Shaw, J., "A certain improvement in a gas motor engine for economizing the consumption of gas, to be worked on the compound principle." Sept. 12.

14,381.—Briglmen, F., "Improvements in Bunsen burners." Sept. 12.

14,385.—Fairlie, T. F., "An apparatus for indicating the height of the water or other liquids in cisterns, tanks, and the like." Sept. 12.

14,421.—Williams, H., "Improvements in the manufacture of the gas commonly styled 'water gas,' and in apparatus employed in such manufacture." Sept. 13.

14,425.—Williams, H., "Improvements in carburetting gas, and in apparatus therefor." Sept. 13.

14,547.—Glover, S., and Bishop, C. J., "Improvements in and relating to gas-lamps." Sept. 16.

14,686.—Howell, H., and Smith, L., "A new or improved automatic carburetter or apparatus for enriching or generating illuminating gas from volatile liquid hydrocarbons." Sept. 17.

14,715.—Mansfield, E., "Improvements in oil-gas apparatus." Sept. 17.

14,731.—Barnett, C., "Automatic lighting and extinguishing street gas-lamps without electricity." Sept. 17.

14,734.—Candy, F. P., "Improvements in the deodorization and purification of sewage and other polluted water." Sept. 17.

14,748.—Ribbans, E. C., "Improvements in or relating to regenerative gas-lamps." Sept. 17.

14,839.—Robson, J., "Improvements in gas-engines." Sept. 20.

14,869.—Sporton, H. H., and White, E., "Improvements in fluid-meters." Sept. 20.

14,881.—Kitt, A., "Improvements in gas-making apparatus." Sept. 20.

14,884.—Scott, J., "Improvements in and connected with 'non-regenerative' gas-lamps." Sept. 20.

14,896.—Wadsworth, J., "An improved anti-fluctuator in connection with the supply of gas." Sept. 21.

14,992.—Kitson, A., "Apparatus for manufacturing heating gas." Sept. 21.

Correspondence.

[*We are not responsible for the opinions expressed by Correspondents.*]

THE "NEW ATMOSPHERIC GAS-BURNER."

SIR,—The method of opening and closing the air-holes in a vertical Bunsen burner, described in the paragraph on p. 600 of your last issue, can hardly be described as new. Such burners, in various forms, in which the cap was either revolved or lifted by the motion of the gas-tap, have been commonly sold for many years past; and I think I am within the mark in stating that I used burners of this kind at least 15 or 16 years ago. Their actual value and advantage may probably be fairly assessed by the fact that I have not seen one in a dealer's shop for the last five years. It may be desirable to mention that any such arrangement is totally useless on horizontal mixing tubes. In these the air supply is automatic and self-adjusting, without mechanical assistance of any kind.

THOS. FLETCHER.

Warrington, Sept. 25, 1889.

THE SALFORD CORPORATION FRAUDS.

SIR,—I have proved every statement made with respect to this matter, and have accepted the challenge of the gentleman you refer to I presume, who has offered to deposit £2000, but not on the conditions you mention—only, if he will disclose his name. Whatever assertions I have made are true. Neither you nor the paper referred to correctly reported me, as is proved by the reporters specially engaged, and whose report will be produced at the proper time. Happily there are two sides to this question; and your abuse and that of the "local press" (save the mark!) to which you refer, goes for what it is worth. You fail also to mention any reply to the letters of the Town Clerk of Salford to which you refer—another evidence of your bias. Why? You also fail to notice letters in reply to the Town Clerk of Salford, from late members of the Gas Committee, in the *Manchester Guardian*. I have not found that the Town Clerk replied. It cannot be too generally known that the Bill to prevent and punish bribery, introduced by Lord Randolph Churchill, is now law.

THE "DEALER IN FICTION."

Sept. 25, 1889.

ROSS GAS COMPANY.—A Company under this title has just been registered, without Articles of Association, with a capital of £11,500, in £10 shares, with the object of carrying on the business of gas manufacturers. The first subscribers are all ladies; Mrs. Harris, of Ross, holding 525 shares in the concern, three of the other ladies 88 shares each, and the remainder 87 shares each. The *Financial News* makes merry over the fact of all the shareholders in the Company being ladies; and says it cannot help wondering "where the Man of Ross has got to."

THE PRICE OF GAS IN THE BROUGH DISTRICT.—Complaints are being made in the district of Brough, near Hull, of the price charged for gas; and a petition has been presented to the Directors of the Brough Gas Company asking for a reduction. The figure is 5s. 8d. per 1000 cubic feet, as against 4s. at Hessle, 2s. 6d. at Cottingham, and 1s. 10d. at Hull. The petitioners suggest 2s. 2d. as the figure which should be charged, or 6d. more than that fixed for one consumer in the district, who, it is said, has recently brought pressure to bear upon the Company. Some of the consumers, it is reported, have already adopted oil-lamps in the hope of giving a spur to the Directors.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.—In the report of the Directors of this Company presented to the proprietors at their half-yearly general meeting yesterday, the total revenue for the six months ending June 30 last, including £1239 for interest, was stated to have been £114,104. The expenditure having been £83,439, there was a net profit of £30,665. This added to the balance of £4095 carried forward made a sum of £34,760 available for division. The Directors recommended the payment of dividends at the rate of 10½ and 7½ per cent. per annum on the respective classes of shares. During the six months referred to, the price of gas was 2d. per 1000 cubic feet lower than in the corresponding period of 1888. The receipts for residual products, especially tar, have improved to the extent of £2799. Since the previous meeting of the Company, additional 4 per cent. stock to the amount of £20,650 has been raised, out of the £30,000 authorized some time ago.

THE DANGERS OF OVERHEAD ELECTRIC LIGHT WIRES.—"The queer antics caused by electricity are," says the *Scientific American*, "a daily occurrence. One of the latest happened recently at Evansville, Ind. During a heavy storm a number of electric light and other overhead wires were blown down and crossed, and the electric fluid started out to make things lively about the streets. Sparks were hissing and spluttering in all directions; the Fire Department was called out; and, unaware of the exact state of things, a number of firemen, civilians, and horses were knocked over by electric shocks. Finally a messenger ran to the electric light station, which promptly shut down, when over a dozen persons were found lying about unconscious, and were restored with difficulty—two of the firemen at last accounts remaining in a precarious condition. It is such little occurrences as these which make firemen and the general public alike distrustful of overhead wires, look they ever so innocent."

LEAMINGTON AND THE ELECTRIC LIGHT.—A special meeting of the Leamington Town Council was held on Monday evening last week, to consider the question of the public lighting. It will probably be remembered that in February last the Corporation instructed the Lighting Committee to consider what kind of gas-lamps should be used on the Parade in place of the electric lights; the Council having two months previously decided that notice should be given to the Midland Electric Light and Power Company to determine at the end of the present year their contract for lighting the Parade. The Council paid £500 for the standards, lamps, &c., at present used on the Parade, while the annual payment to the Company for supplying electricity is £400; being double the amount previously paid for lighting the Parade with gas. The Watch Committee recommended that Bray gas-lamps should be substituted for incandescent electric lamps; 60-candle power lamps to be placed at street corners, the intervening spaces to be supplied with 30-candle power Bray lamps. The alterations would cost £300, while the annual charge for gas would be £240 and £30 for cleaning. A general feeling of regret was expressed at the prospect of abandoning the electric light; while several members stated that if Messrs. A. Chamberlain and Hookham were prepared, as reported, to make experiments with the arc light, the Council would be ready to meet them. It was unanimously resolved that the question should be referred back to the Committee for a report on Messrs. Chamberlain and Hookham's opinion of the arc light.

Miscellaneous News.

THE AWARDS IN THE BRITISH SECTION OF THE PARIS EXHIBITION.

The list of the awards in the British Section of the Paris Exhibition was published in the London papers last Saturday. The total number of exhibitors in all the departments is 1017; and as many as 910 prizes (including 43 grand prizes and 218 gold medals) have been awarded. Of the 672 exhibitors in the Industrial Department, 20 have grand prizes, 184 gold medals, 243 silver medals, 179 bronze medals, and 107 honourable mentions. The following is a list of the awards to firms who are connected with the gas and water industries:—

Crossley Bros., Limited.
Farnley Iron Company.
Fletcher and Co., T.
Glenboig Union Fire-Clay Company.
Incandescent Gas-Light Company.
Leeds, L. W., Patent Floor-Warming Stove Company.
London Water-Meter Company, Limited.
Ridsdale's Railway Lamp and Lighting Company.
Sugg and Co., W., Limited.
Wilson and Sons, C.
Yates, Haywood, and Co.

Among the other exhibitors in the Industrial Department who have obtained awards, we notice the following firms and companies with whose names our readers are more or less familiar:—Messrs. G. Angus and Co.; Messrs. Appleby Bros.; Messrs. E. Brooke and Sons; Mr. P. Brotherhood; Messrs. Brunner, Mond, and Co.; Mr. J. H. Carter; Messrs. Chance Bros.; Clayton Aniline Company; Continental Oxygen Company; Credenda Seamless Steel Tube Company; Messrs. J. Dewhurst and Sons; Eglinton Chemical Company; Fairfield Engineering Company; Messrs. Fielding and Platt; Hydraulic Engineering Company; Messrs. Isler and Co; Messrs. Johnson, Matthey, and Co.; Leeds Forge Company; Lucigen Light Company; Maignen's Filtre Rapide and Anti-Calcaire Company; Patent Pump and Power Syndicate; Messrs. Stevens and Sons; United Asbestos Company; Vulcan Fire-Brick Company.

The uniform success of the British exhibitors reflects credit upon the organizers of the Section, among whom may be specially mentioned Mr. Trueman Wood, Secretary of the Society of Arts, the British representative on the Superior Jury, and Mr. F. Cundall, Assistant Secretary to the Commission.

OTTOMAN GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held last Tuesday, at the London Offices, No. 9, Queen Street Place, Cannon Street—Mr. EDWARD HORNER in the chair.

The SECRETARY (Mr. A. J. King) read the notice convening the meeting after which it was agreed to take as read the Directors' report and the accounts for the half year ending June 30, a brief reference to which was made in the JOURNAL last week (p. 611).

The CHAIRMAN said that, in moving the adoption of the report and accounts, he ought perhaps to make a brief statement as to the position of the affairs of the Company. The figures for the half year were very similar to those the Directors had had on previous occasions to present to the shareholders; and he might almost say the differences were quite ridiculous. The cost of coals (£2432 18s.) was only £9 more; wages and materials were £29 less; lamp lighting £3 less; salaries and office expenses had decreased by £2; and the exchange was more by £202. This he regarded as a good item; inasmuch as it showed that the remittances from Smyrna had been what they ought to be. The interest and discount had increased by £28. On the other side of the account, notwithstanding the electric light, the rental for public lamps only differed by £94; while the rental from general consumers was more by £88. The profits on fittings, rents, &c., had increased by £200. He thought their financial position was very satisfactory. In regard to the unaccounted for gas, in the first half year it was 9·74 per cent. The public lamps remained at the same number as in the previous six months—viz., 1601. The quantity of gas made per ton of coal carbonized was 10,485 cubic feet, which he thought the shareholders would agree was very good. Looking at the condition of affairs all over the world, and the different rates of interest which prevailed, it was something to be able to say that they were in the same position as, and perhaps rather better than before.

Mr. A. J. DOVE seconded the motion, which was, without discussion, carried unanimously.

On the motion of the CHAIRMAN, seconded by Mr. CHARLES GANDON, a dividend was declared on both classes of shares at the rate of 7 per cent. per annum, free of income-tax.

The CHAIRMAN said that the Directors had one great cause of regret, and that was the loss of their colleague Mr. Arthur Clarke. He was an excellent Director; and it was indeed a very grievous thing to lose so good a man and friend as he was. In his place, they had elected Mr. Gandon, who perhaps knew more about the Company and its working than any one else, as he was their first Engineer. He (the Chairman) considered they had been most fortunate in their selection. Before he sat down, he would move that a vote of thanks be given to the officers.

Mr. DOVE seconded the motion and it was agreed to.

Mr. R. HESKETH JONES said he wished to congratulate the Directors and the shareholders on the great acquisition they had made in getting Mr. Gandon on the Board. He did not think they could find any one more suited to occupy the position than that gentleman, who had filled the office of President of The Gas Institute and the Society of Engineers; and besides he was thoroughly acquainted with the Company's works. He concluded by moving a vote of thanks to the Directors for the attention which they had given to the conduct of the business during the past half year.

Mr. ANDREWS seconded the motion, which was passed.

The SECRETARY acknowledged the vote of thanks accorded to the officers. He remarked that their Engineer (Mr. Andrews) was one of the largest shareholders in the Company, and he was interested in every way in its success, as his emoluments were as much by commission, as by direct salary. It would be very gratifying to him to receive his dividends and the assurance of the esteem in which he was held by the Directors and shareholders.

The CHAIRMAN, in responding on behalf of himself and his colleagues, called to the shareholders' recollection the fact that he was one of the original proprietors who started the concern; and he said he had ever given his best attention to the business of the Company. He was now nearer 80 than 70 years of age; and as long as he was spared he should do his best for the Company.

The proceedings then terminated.

COMMERCIAL GAS COMPANY.

The following is the report of the Directors of this Company, which, with the accounts for the half year ending June 30 last (the principal portions of which are given below), will be presented at the ordinary general meeting of the proprietors to be held on Friday next:—

The revenue account shows a net profit for the half year of £51,949 7s. 6d.; making, with £1294 7s. received for interest, £53,243 14s. 6d. This, added to the amount brought forward from previous half years, makes £113,736 0s. 4d. Deducting therefrom £2925 for interest on debenture stock, there remains standing to the credit of the net revenue account a balance of £110,811 0s. 4d., of which, having regard to the sliding scale and the price of gas charged during the half year, £45,650 is available for dividend. The Directors recommend the payment of dividends, at the rates of £13 15s. per cent. per annum upon the old stock of the Company, and of £10 15s. per cent. per annum upon the new stock: both less income-tax. The balance of the net revenue, £66,011 0s. 4d., will be carried forward to the next half year.

The accounts accompanying the report consist of the usual statements. The statement of capital stock (No. 1) stands as before—£680,000 paid up, out of a total of £830,000 authorized. The statement of loan capital (No. 2) shows that a sum of £130,000 has been borrowed, out of £300,000 authorized. The total capital called up at the close of the past half year was therefore £810,000. The capital account (No. 3) shows a total expenditure of £813,955 17s. 6d.—being the sum actually laid out (£813,994 7s. 6d.) less £38 10s. received as premiums on debenture stock issued—of which £5596 3s. 5d. was spent in the past half year on new works, mains and services, meters, and stoves. The amount in hand on this account at the close of 1888 has been used, and there is now a debit balance of £3955 17s. 6d. The remaining statements are as follows:—

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—				By Sale of gas—		
Coals, including dues, carriage, unloading, and trimming (see account No. 8)	£58,658 13 9			Common gas, per meter, at 2s. 6d. and 2s. 4d. per 1000 cubic feet	£106,998 11 6	
Salaries of Engineers, Superintendents, and other Officers at works	2,088 10 10			Public lighting and under contracts, common gas	8,943 11 6	
Wages (carbonizing)	12,498 19 5			(See statement No. 10.)		£115,942 3 0
Purification, including £1455 18s. 1d. for labour	3,012 8 0			Meter-rental	£1,811 12 11	
Repairs and maintenance of plant and works, materials and labour (less £153 17s. 10d. received for old materials)	11,647 3 1			Stove-rental	462 19 2	
		£87,905 15 1				2,274 12 1
Distribution of gas—				Residual products—		
Salaries and wages of Officers (including Rental Clerks)	£2,253 16 7			Coke, less £2864 16s. 2d. for labour	£23,858 14 2	
Repairs, maintenance, and renewals of mains, service-pipes, and fittings, including labour	1,459 1 5			Breeze, less £356 4s. 7d. for labour	483 13 1	
Repairs and renewals of meters and stoves	1,619 16 5			Tar	6,629 1 6	
		5,333 14 5		Ammoniacal liquor and sulphate	10,380 14 4	
Public lamps—						41,352 3 1
Lighting and repairing		2,153 9 5		Miscellaneous receipts—		
Allowance to Whitechapel District Board of Works		175 0 0		Rents	£101 16 2	
Rent, rates, and taxes		5,087 14 3		Transfer fees	20 10 0	
Management—						122 6
Directors' allowance	£1,250 0 0					
Company's Auditors	75 0 0					
Salaries of Secretary, Accountant, and Clerks	1,064 9 6					
Collectors' salaries and commission	1,568 4 7					
Stationery and printing	435 7 1					
General charges	459 6 1					
		4,852 7 3				
Bad debts		1,109 2 11				
Law and Parliamentary charges		148 17 0				
Superannuations		883 14 8				
Official officers		93 1 10				
		£107,741 16 10				
Balance carried to profit and loss, net revenue account (No. 5)		51,949 7 6				
		£159,691 4 4				£159,691 4 4

No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).

Interest on debenture stock	£2,925 0 0	Balance, Dec. 31, 1888	£105,292 5 10
Balance available for dividend, carried to balance-sheet	110,811 0 4	Less amount of dividend paid for half year ending Dec. 31, 1888	44,800 0 0
			£60,492 5 10
		Balance from revenue account (No. 4)	51,949 7 6
		Dividends and interest	1,294 7 0
	£113,736 0 4		£113,736 0 4

No. 6.—RESERVE FUND.

Balance on June 30, 1889	£44,879 5 1	Balance on Dec. 31, 1888	£44,879 5 1
	£44,879 5 1		£44,879 5 1

No. 7.—INSURANCE FUND.

Balance on June 30, 1889	£34,000 0 0	Balance on Dec. 31, 1888	£34,000 0 0
	£34,000 0 0		£34,000 0 0

No. 8.—STATEMENT OF COALS.

Description of Coal.	In Store, Dec. 31, 1888.	Received during the Half Year.	Carbonized during the Half Year.	In Store, June 30, 1889.
	Tons.	Tons.	Tons.	Tons.
Common	17,115	100,976	93,321	84,770
Cannel	1,465	2,471	3,685	251
	18,580	113,447	97,006	85,021

No. 9.—STATEMENT OF RESIDUAL PRODUCTS.

——	In Store, Dec. 31, 1888.	Made during the Half Year.	Used during the Half Year.	Sold during the Half Year.	In Store, June 30, 1889.
Coke—chaldrons of 36 bushels*	13,712	126,884	34,817	95,048	10,731
Breeze do. do.	1,608	11,516	—	12,590	534
Tar—gallons	245,200	989,175	—	1,106,273	128,100
Ammon. liq.—butts of 108 gals.	5,723	35,558	37,400	—	3,836
Sulphate of Ammonia—tons	163 2/20	1,209 5/20	—	995 17/20	377

* Under "Weights and Measures Act, 1878."

No. 10.—STATEMENT OF GAS MADE, SOLD, ETC.

Description of Gas.	Quantity Made. Meter Register.	Quantity Sold. Public Lights and under Contracts (estimated).	Quantity Sold. Private Lights (per Meter).	Quantity Sold. Total Quantity Sold.	Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lights.
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	995,037	56,379	877,815	934,194	10,945	945,139	49,898	5,158

BALANCE-SHEET.

To Capital—				By Balance, per account No. 3		£3,955 17 6
Net Revenue—				Cash at Bankers		43,661 0 0
For balance, per account No. 5		£110,811 0 4		Cash in hand for current expenditure		1,400 0 0
Reserve Fund—				Amount invested in Consols		78,379 5 1
For balance, per account No. 6		44,879 5 1		Stores in hand—		
Insurance Fund—				Coals	£20,493 0 0	
For balance, per account No. 7		34,000 0 0		Coke and breeze	2,980 0 0	
Unclaimed dividends		1,859 18 7		Ammoniacal liquor and tar	6,317 18 0	
Deposits		8,800 2 4		Sundries	5,940 13 0	
Interest on debenture stock		164 8 2				35,671 11 1
Sundry tradesmen and others, for amount due for coals, stores, and sundries		9,566 5 1		Accounts due to the Company—		
				Gas-rental, quarter ending June 30, 1889	£41,641 17 6	
				Arrears outstanding	1,719 19 8	
						43,361 17 2
				For coke and other residual products	£2,833 11 3	
				Sundries	407 17 6	
						3,241 8 9
		£209,670 19 7				£209,670 19 7

ELECTRIC LIGHTING AT CHELTENHAM.—The Cheltenham Town Council will hold a special meeting on the 21st inst., for the purpose of deciding whether application shall be made to the Board of Trade for a Provisional Order authorizing the Corporation to supply electricity for public and private use within the borough. The townspeople have during the past few days had an opportunity of judging the effect of the electric light for street-lighting purposes; a couple of arc lamps, of a reputed illuminating power of 1200 candles each, having been suspended in the Promenade. The Industrial Exhibition now being held in the Winter Gardens is also illuminated by the electric light.

THE STAFFORD CORPORATION AND ELECTRIC LIGHTING.

A short time ago the Stafford Corporation, in company with many others, received an intimation of the intention of an electric lighting company to apply for powers of supply in their district; and the consent of the municipal authority was sought to the application. The subject has just been reported upon to the General Purposes and Gas Committees, to whom the matter was referred, by the Town Clerk (Mr. M. F. Blakiston) and the Gas Engineer (Mr. J. Ferguson Bell), whose reports are as follows:—

Report of the Town Clerk.

On the 29th of June, 1889, the Midland House-to-House Electricity Company, Limited, served a notice on the Corporation that they intend to apply for a Provisional Order for powers to supply electric lighting within the borough. The notice is in accordance with section 4 of the Electric Lighting Act, 1882. The Board of Trade are empowered, under the Act of 1882, to grant Provisional Orders to any local authority, company, or person; but by Rule 2, the Board of Trade will give a preference to the application of the local authority in every case where, in their opinion, no special circumstances exist which render such a preference inexpedient. Moreover, the rights of the local authority are further protected by the Electric Lighting Act, 1888, which provides that no Provisional Order shall be granted except with the consent of the local authority, unless the Board of Trade, in any case in which the consent of the local authority is refused, are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with; and in such case they are required to make a special report, stating the grounds upon which they have dispensed with such consent. The Town Council have now to decide whether they will consent to a Provisional Order being granted to the Company or oppose it; and in the latter case they must decide whether or not they shall themselves apply for a Provisional Order to empower them to supply electric lighting within the whole or any portion of the borough.

By the Act of 1888, the period at the expiration of which the Corporation could claim to purchase the works from any company has been extended from 21 years (prescribed by the 1882 Act) to 42 years. By the same Act the grant of powers to a company to supply electricity within the borough will not hinder or restrict the granting of a Provisional Order to the Corporation or any other Company; but expensive litigation and great inconvenience could not but ensue from the granting of powers to two bodies, and should be avoided.

The course of proceedings for the purpose of obtaining a Provisional Order by the Corporation must be as follows:—The application must be made in pursuance of a resolution passed at a special meeting of the Town Council after one month's previous notice of the same and of the purpose thereof. Then notice of the application must be published in the months of October or November, in two successive weeks, in some one and the same newspaper published and circulating in the borough and once in the *London Gazette*. The Provisional Order should be for a prescribed area; but may confer powers to extend the area from time to time. The Corporation would probably be required, within a period of two or three years, to erect and lay down suitable works and sufficient distributing-mains for the purposes of general supply throughout the streets specified in the prescribed area; and if they make default in laying down such mains, the Board of Trade would have power to revoke the Order as to the whole or part of the area of supply.

The Corporation, after obtaining the Provisional Order, might contract with any company for the execution and maintenance of any works needed for the supply, or for the supply of electricity within the limits of the Order; but not, by any such contract, to divest themselves of any legal powers given to them, or any legal liabilities imposed on them by the Act, without the consent of the Board of Trade. This would enable the Corporation to make terms for the best-known system of supply without incurring the capital outlay of establishing works.

The profits to be made by the Corporation would probably be limited so as not to exceed 5 per cent., after providing for interest, sinking fund, and reserve fund. But this limitation would only apply to so much of the undertaking as should for the time being remain in the hands of the Corporation; so that if they transferred any part of the undertaking to any other body or person, the limitation as to profits would not apply.

With regard to the nature and mode of supply of electricity, the form of Provisional Order would allow of any system approved of by the Board of Trade being used. It will therefore be unnecessary, in regard to a Corporation Provisional Order, to define any system; but if the application by the Company were entertained, the subject would have to be carefully considered by the Town Council before giving any consent.

The expenses incurred by the Corporation under the Electric Lighting Acts would have to be defrayed out of the general district rate; and they could borrow, subject to the consent of the Local Government Board, and in accordance with the provisions of the Public Health Act, 1875, the necessary moneys for capital expenditure.

The practical questions to be considered would seem to be:

(1) What is the minimum demand for electric lighting for public and private purposes within the borough which would justify the establishment of works of supply, and within what area?

(2) What is the minimum capital outlay that would be necessary for such area?

(3) What is the minimum price of supply that would be remunerative, and what would be the equivalent price of gas?

Each of these questions is dealt with in the

Report of Mr. Bell.

(1) In my opinion, it would not be advisable to erect a central electric lighting station, unless there is a probability of a minimum of 2000 (16-candle power) incandescent lamps being required within the area of supply. I have scheduled the streets, &c., which might advantageously be comprised in the first area to be dealt with. Unless sufficient consumers can be obtained within that area who will undertake to pay for not less than six (16-candle power) incandescent lamps each during a period of two years, at a fixed price per light, and making an aggregate number of lights equal to 1200 (16-candle power) lamps, and yielding a revenue of at least £2400 per annum, the Town Council would not be justified in establishing electric light works. It is not probable that any company would erect works for a smaller installation. Certainly a less number of lights could not pay working expenses and yield reasonable interest on capital expenditure.

(2) The Corporation have sufficient land on the east side of the gas-works for the establishment of a central electric lighting station; and being near the centre of the town, it would be an excellent site, and it will not be required for gas-works purposes.

I have obtained a large amount of valuable information on the working of the two systems now in use for electric lighting from central stations —*i.e.*, alternating transformer and accumulator transformer distribution, and which I will now refer to respectively as the "A.T." and the "B.T." systems.

In the "A.T." system, the electricity is generated by means of an alternating current dynamo; and the distributing plant consists of two mains running round the circuit, and which are charged direct at an electromotive force (E.M.F.) or pressure of 1000 volts and upwards. The electric energy is then converted, by means of transformers, into a current of 100 volts or less to supply either one or more consumers using from 6 to 100 (16-candle power) glow lamps within a short radius.

The "B.T." system is the distributing of a continuous current of electric energy by means of secondary batteries. The electricity in this case is generated by a continuous-current dynamo, which charges a single circuit at a high E.M.F.; and at different points on this circuit are secondary batteries or accumulators. These consist of 53 cells, which have been termed appropriately "reversible," because they can be charged and discharged without the addition of fresh chemicals. In other words, they *store up* the electric energy. If this method of supplying electricity were adopted, it would be necessary to divide the current from the central station by means of sub-stations placed at different parts of the circuit, which would contain these storeage batteries. The mains could then be run from 200 to 300 yards from these secondary batteries, so as to supply any lights required on the small circuits.

The opinions of electricians are divided on the merits of these two systems; but it appears that the "A.T." system is being more largely adopted than the other. The advantage of the "B.T." system is that the electricity can be stored, so that breakdowns in the machinery would make no difference in the lights; also the electricity can be generated during the daytime ready for evening consumption. But, unfortunately, these storeage batteries require a large amount of skilled attention; and the automatic governor for regulating the charging of the cells is delicate and liable to get out of order. Further, the depreciation of these cells is a factor of some importance.

The "A.T." system is a comparatively simple mode of distributing electricity; but in case of any breakdown in the machinery, the supply of electric energy would fail. The machinery has also to be kept in motion, although only few lights may be actually required. If a constant supply is required, the machinery must be kept running continuously. Still, if the Corporation erect a central station, I am inclined to recommend the "A.T." system. As a rule the consumers would probably not object to the supply being off from midnight until lighting time the following day, as is now done by the Exeter Electric Light Company. Provision could, of course, always be made for exceptional seasons or occasions, so as to provide continuous lighting. The cost of either system for capital expenditure would be practically the same; and it is not necessary now to finally decide the system. On the whole, however, I believe, the "A.T." system has advantages which would make it best for Stafford; and the cost for working expenses and maintenance would probably be less than the "B.T." system.

Accordingly, I estimate for a complete alternating transformer distributing system, to supply a minimum of 2000 (16-candle power) incandescent glow lamps; the electric station to be established by the side of the gas-works, and to be worked in connection with same. Now as regards the motive power which will be required to drive the dynamos. Where a convenient water supply can be obtained from natural sources, as in the case of a river with sufficient fall and discharge, it is, of course, the best and cheapest method to employ for power. These conditions unfortunately do not apply at Stafford; and we need only consider the question of steam or gas engines, which must be of 300-horse power, to work three dynamos up to their full capacity. The adoption of gas-engines, working during the summer months with ordinary lighting gas, and in the winter with producer gas, would be a very cheap mode of obtaining power. Gas-engines worked by means of Dowson's fuel gas give an efficiency of 1¼ to 1½ lbs. of coal per indicated horse power per hour, which is less than one-half the fuel account of best high-pressure compound steam-engines, even when worked under favourable conditions. However, as we should require engines each capable of working up to 100-horse power without undue wear and tear, I do not feel justified at present in recommending gas-engines; for as I should propose lighting direct from the dynamos, we must have engines such as will run perfectly steady, and be well able to stand the heavy work of driving dynamos. For small installations, Otto gas-engines are doing good service; but I feel it necessary to have more information on the working, both as regards steadiness and reliability, of such large gas-engines as 100-horse power before I take the responsibility of recommending them. The capital expenditure for equal steam or gas power would be practically the same; but the cost of working the latter would be much less than steam. For the present I base the estimates for motive power upon the cost of obtaining and working three 40 nominal horse power high pressure compound horizontal steam-engines, each of which could easily be worked up to 120-horse power when running at a moderate speed. The boilers to be of Lancashire type, made of steel, and to work at an initial steam pressure of 120 lbs. per square inch. The machines used to generate the electricity to be three alternating current dynamos, each capable of supplying 1050 (16-candle power) lamps, after allowing 10 per cent. for loss in leads and converters, when running at a speed of 480 revolutions per minute along with exciters running at 800 revolutions per minute. The current to be divided into three circuits working at an E.M.F., or pressure of about 1000 volts, and distributed to consumers by means of converters—these reducing the current to 100 volts, or less if required.

In accordance with the foregoing general description of an "A. T." central electric light station, I now give the estimated cost of such an installation:—

Buildings, which include engine and dynamo house, boiler house, chimney, &c.	£1250
Three 100-h.p. high-pressure comp. steam-engines with 14 and 24 inch cylinders and 36-inch stroke, fixed complete	2,250
Two 30 by 7 ft. 6 in. Lancashire steam-boilers, steam-pipes, fixing, &c.	1,000
Three alternating current dynamos complete, with exciters each capable of supplying 1050 (16-candle power) incandescent lamps	2,250
150 transformers	1,500
Charging and distributing mains	5,000
Regulating and testing instruments	250
Contingencies	1,000
Total cost	£14,500

The above is an estimate for a complete central electric lighting station capable of supplying 3000 (16-candle power) incandescent lamps, so designed that, when the lights reach about that number, another 1000-light dynamo and steam-engine could be added; and so on for each additional 1000 lights—always having sufficient spare engine and dynamo power in reserve in case of a breakdown or stoppage of the other machines.

(3) To compare the cost of electricity as against gas, having equal illuminating power, when the former is used in 16-candle power incandescent lamps and the latter in ordinary flat-flame burners, we have simply to multiply the price charged per unit (1000 watts) by 10, and it gives the cost of gas per 1000 cubic feet. An Edison-Swan lamp of 16-candle power, when run at an E.M.F. of 100 volts, requires 0·60 ampère, which equals 60 watts

or volt-ampères. This is 3·7 watts per candle; and 1000 ÷ 3·7 = 270 candles for each 1000 volt-ampère hours, which is the Board of Trade unit for charging consumers of electric energy. Coal gas, when used in an ordinary burner, gives 3 candles per cubic foot; and thus to obtain 270 candles, we should require to use 90 cubic feet of gas. Glow lamps can be worked at a higher efficiency than 3½ watts per candle power; but the life of the lamp is thereby shortened. We may therefore, in practice, consider 100 cubic feet of 17-candle gas equal to 1000 watts. When arc lamps are used for lighting large spaces, they give an efficiency of 1 to 2 candles per watt, and are therefore considerably cheaper, as regards electric energy, than glow lamps; but they require attention, and are not adapted for indoor illumination, unless the space is large and open.

The prices now charged by electric supply companies vary from 7½d. to 8d. per unit, being equivalent to gas of from 6s. to 6s. 8d. per 1000 cubic feet), and meter-rents from 5s. to 7s. 6d. per quarter; also 7s. 6d. to 30s. per quarter for converter, main fuse, switch, &c., according to the number of lights in use. If the Corporation undertake electric lighting, I am of opinion that the charge should be as follows:—

10-candle power incandescent lamps . . .	25s.	0d.	per annum each.
16	"	"	" . .	40	0	"
25	"	"	" . .	62	0	"
50	"	"	" . .	125	0	"
100	"	"	" . .	250	0	"

In special cases the charge to be, if by meter, at 7d. per unit, which is a 1d. per unit less than the House-to-House Electric Supply Company are now charging in Kensington. I think, however, it would be advisable to charge in the first instance a definite price per lamp per quarter; for consumers will then be able to tell exactly the cost of lighting by electricity before making any alterations. Further, the cost of electrical meters is from £10 upwards; and I believe a meter well adapted for general use is yet to be invented.

The time of lighting during twelve months for indoor illumination does not exceed 1500 hours; and the following shows the cost for a 16-candle power gas-light, if used for this time, at the present charges for gas in Stafford:—

Gas. . .	1500 hours × 5 c.f. = 7500 c.f., at 3s. per 1000 c.f.	=	22s. 6d.
Electric .	Proposed charge for a 16-c.p. glow lamp . .	=	40 0

The cost per annum for a 16-candle power electric glow lamp, if charged by meter, and at 7d. per Board of Trade unit, would be, if used for 1500 hours, about 52s.

The financial aspect of a central electric lighting station, carried out in accordance with the general outline as before briefly set forth, would be as follows:—

When 1200 (16-candle power) lights are used, or an equal quantity of electric energy consumed, during a year of 2000 hours:

Expenditure—			
Capital of installation complete and capable of supplying 3000 (16-c. p.) incandescent lamps as per estimate, £14,500.			
Interest on capital	£14,500 at 3½ per cent.	=	£507 10 0
Renewals and depreciation. .	14,500 at 7½ "	=	1087 10 0
Working expenses, including fuel, oil, and labour, but no allowance for management			600 0 0
Total cost per annum .			£2195 0 0
Revenue—			
1200 (16-c. p.) glow lamps, at 40s. each per annum . .			£2400 0 0

When 2000 (16-c. p.) lights are used, or an equal quantity of electric energy:

Expenditure—			
Interest on capital	£14,500 at 3½ per cent.	=	£507 10 0
Renewals and depreciation. .	14,500 at 7½ "	=	1087 10 0
Working expenses when supplying 2000 lights, which include fuel, oil, and labour, but no allowance for management			840 0 0
Total cost per annum .			£2435 0 0
Revenue—			
2000 (16-c. p.) lamps at 40s. each per annum, or lights equal to this quantity.			4000 0 0
Surplus towards replacement of capital and profit			£1565 0 0

Mr. Bell's report closes with the schedule referred to by him; and the Town Clerk concludes by expressing the hope that the two documents submitted by his colleague and himself to the Committees will enable them to arrive at a satisfactory decision on the important question referred to them.

LEICESTER CORPORATION GAS SUPPLY.

The Half-Year's Accounts—The Question of Meter-Rents.

At the Quarterly Meeting of the Leicester Town Council on Tuesday—the Mayor (Mr. Alderman E. Wood) presiding—the Gas Committee reported that the accounts of the undertaking for the half year ended June 30 last showed that there was a net profit, after paying interest on the capital of the undertaking, of £16,011. Out of this had been paid £2634; being the half-year's amount of sinking fund—leaving a balance of £13,377 to be applied at the end of the official year (March 25 next) as the Council might, under the Acts of 1878 and 1884, direct. The accounts included the result of the working of the residual products department and the gas-fitting business. The net amount realized by the former was £7226; and the gas-fitting business showed a net profit of £226. During the half year, 44,564 tons of coal were carbonized. The quantity of gas made was 450,370,000 cubic feet, as against 437,494,000 cubic feet for the corresponding half of last year; being an increase of 12,876,000 cubic feet, or 2·94 per cent. The average illuminating power of the gas had been: At the Belgrave Gate works, 17·23 candles; Aylestone Road works, 17·27 candles; Town Offices, 16·76 candles. Considerable progress, it was stated, had been made with the extension of the Aylestone Road works. No. 3 gasholder was nearly completed. The retort-house, coal-stores, and mechanics' shops were finished; and the internal fittings were now in hand. There was every probability that the whole of the extensions would be completed and ready for the manufacture of gas by the autumn of next year.

Mr. Lennard, in moving the adoption of the report, said he thought the Council, after glancing through the balance-sheet, must come to the conclusion that it was a very satisfactory one. The first item he wished to draw attention to was that, for the half year ending June 30, they had for disposal the handsome profit of £13,377, or £1015 more than in the corresponding half of last year. With regard to the revenue account, he pointed out that the total expenditure of upwards of £39,000 showed an increase over the first half of last year of £1593. There had been £318 more paid in salaries than in the preceding six months, and £295 more for repairs and maintenance of works. On the capital account the sum of £1352 had been laid out in new mains; £345 for new meters; and £13,194 on the new works. The stock had been taken in a very fair way, liberal depreciation having been allowed on the machinery. They considered it right, with their very huge capital, that they should be liberal in this direction; and they hoped the Council might soon see its way clear to allow the Committee a little more out of the profits to spend in improvements without trespassing on the capital account, because they thought that would be the right policy to pursue. On the whole, the Council might take it that everything was going on satisfactorily. They were not letting any of the plant go into decay; the sum of £4417 having been spent in repairs and maintenance during the half year. He might mention that since the department came into the hands of the Corporation, the total sum placed at the disposal of the Council from the profits was £81,497. Looking at the profit they were making, and bearing in mind that they were paying interest on the new and as yet unproductive works, it was a striking fact, and spoke well for their future, that while the old works were producing 5 million cubic feet at a rate of cost of £120,000 per million cubic feet, the new works would produce 4 million cubic feet at a cost of £30,000 per million cubic feet. This spoke well for the future; and he thought they might expect to have a good balance-sheet next year. For the present year they would have to pay £10,000 extra for their coal; but he did not regret that, because it showed that colliers and others were getting better wages, and that the spending power of the public was very much larger. They could afford to pay the increased price considering the profits they were making. The Committee were going to spend £1500 a year more on purifying than they had been doing in the past. They had decided to adopt more extensive and costlier means for purifying the gas. At the present time they had 23,012 customers on their books; and this spoke well for the administration of the department. There was one fact that reflected the highest credit on their Engineer (Mr. A. Colson), and that was that their residuals had produced 72 per cent. of the entire cost of coal. He believed that was a state of things not surpassed by any other Corporation or public body in the kingdom. In conclusion, he spoke in eulogistic terms of the ability of the Engineer, and the uniform courtesy he always displayed.

Alderman Bennett seconded the motion; and in doing so said it was exceedingly gratifying to find that the profits of the half year had been so large. It was a good omen that, although the price of coal had risen, the price of residuals had also risen; and that although the coals during the next half year might cost them £10,000 more, they would have a considerable sum to receive out of residuals to make up in some degree for that otherwise formidable loss. In the neighbouring town of Nottingham, the consumption of gas had decreased very considerably, in consequence of bad trade; but owing to the prosperity of Leicester and the adoption of gas by many residents in the suburbs, the consumption had increased very largely during the last half year. He endorsed Mr. Lennard's remarks as to the able manner in which Mr. Colson managed the works, and expressed the hope that in March next the Council would allow the Committee to add a considerable sum to the reserve fund. It was certainly very desirable that this should be done.

Mr. Collin inquired if anything more had been done with respect to the reduction of meter-rents.

Mr. Shires suggested the desirability of making and adopting a uniform charge for gas to those living outside the borough boundaries.

Mr. Biggs also advocated the entire abolition of meter-rents.

Mr. Lennard said the gentleman who had introduced the question of the meter-rents knew he (the speaker) was in sympathy with him. He took steps in Committee some four years ago to have the rents reduced and put them all on one footing; but the Committee did not see their way clear to abolish them at present. Such a step would involve the purchase of every private meter in the town to begin with; and they would have to lay out from £15,000 to £18,000 upon that alone. This was not the time for any action of that kind. Consideration must be given to the present smallness of the authorized capital of the department, and the demand for the electric light; and they must wait. With regard to Mr. Shire's suggestion, he would say that they had considered the out-districts, who were now being supplied with gas at a cheaper rate than they could obtain it anywhere else. They had reduced the price of gas in the out-districts from 3s. 4d. to 2s. 8d.; and the consumers in the suburbs ought to be very thankful for it.

The Mayor congratulated the Committee on the very admirable report and balance-sheet they had presented. He emphasized what had been said in reference to putting some of the profits to the reserve fund. He reminded the Council of the very peculiar position they stood in as a large trading concern involving nearly three-quarters of a million capital and with a reserve fund of only £5000. They might have an accident any day at the works which would mean the destruction of £10,000 or £15,000 worth of property. In view of probable competition by the introduction of the electric light, and the increased price of coal, it was the duty of the Corporation to put away a larger sum to the reserve fund than they had hitherto been in the habit of doing. In fact, they ought to allow the Committee to carry at least from £5000 to £10,000 a year to the reserve-fund during these very prosperous times.

The motion was agreed to.

Mr. Collin then moved that the rent of meters be reduced from 8d. to 6d., and urged that it would be a great boon to the working classes.

Mr. Kell seconded the proposition.

The Mayor said he was quite sure the Gas Committee would take the matter into consideration as soon as their position would enable them to do so. He thought they might trust the Committee to give the public every possible boon which circumstances justified.

Mr. Wakerley contended that the only way to benefit the working classes was to reduce or abolish the meter-rents.

Mr. Lennard claimed that the Committee had studied the working classes very considerably in that question in quite as direct a manner as by reducing the meter-rents. The price of the gas itself had been reduced from 2s. 10d. to 2s. 4d. per 1000 cubic feet. They had, however, to take everybody into consideration, and deal with the matter in a business-like way. The Council might rest assured that the Gas Committee had anticipated all that could be said in favour of abolishing meter-rents; and when the right time arrived, they would deal with the question in a proper spirit, and treat everybody aright. If there was any preference at all to be given, it would undoubtedly be in favour of the working class.

The proposition was then put, and lost by a large majority.

Lead-Poisoning at Rochdale.—Last Tuesday an inquest was held by Mr. F. N. Molesworth, at Rochdale, on the body of a child, aged four years, the son of a Mr. Rowbotham. Dr. March informed the jury that the father, mother, and three other children were now suffering from lead-poisoning. The deceased's death he attributed to the same cause, and said the child had been very fond of drinking the water supplied to the house. He believed there was a large amount of lead-poisoning in the town; and other professional gentlemen complained of the same thing. The Coroner said that lead-poisoning was on the increase, as there had been a death of a child in the same family last week. It was a question that ought to be taken up by the sanitary authorities. The jury returned a verdict in accordance with the medical testimony.

THE LOTHAMMER GAS MANUFACTURING COMPANY, LIMITED.

An Extraordinary General Meeting of this Company was held yesterday, at Winchester House, Old Broad Street, for the purpose of considering the contract entered into with Mr. George Bower, of St. Neots—to which reference was made at the recent statutory meeting (*ante*, p. 416)—to ask the sanction of the shareholders to an alteration of the Articles of Association, and to alter the number of Directors to form a quorum from three to two. As our representative was refused admission to the meeting, we are unable to give a full report of what transpired. We understand, however, that the Chairman (Colonel H. Y. Murray) explained the nature of the arrangement entered into with Mr. Bower; and the Solicitor read the agreement. Mr. Bower then stated that he was willing to retire from his agreement if there was an expression of opinion that it should not be entered into; and he explained that it was not he who had run after the Lothammer Company, but the Directors who—having seen what he could do independently of the Lothammer apparatus—had unanimously resolved to enter into the contract with him. The contract embraces the payment to him of £15,000—half in debentures, and half in shares—and the manufacture of all the Company's apparatus. He also ceases to supply coal-gas apparatus below 100 lights; and engages to recommend his wide connection to have air-light instead. The motion agreeing with the Directors' action in entering into the contract was then put to the meeting, and was unanimously carried. The Chairman next stated that the Board wished Mr. Bower to be a Director; but before inviting him to a seat, the Directors had obtained Counsel's opinion, which was that Mr. Bower could be on the Board, but he must not vote on any matter in which he was personally interested. Mr. Bower then stated that he would not join unless it was the unanimous wish of the shareholders that he should do so, for he recognized the abnormal position he would hold. The resolution electing Mr. Bower to the Board was unanimously passed. The shareholders were next asked to agree to a motion that two Directors, instead of three, should form a quorum. To this proposal there was much opposition; and in the end, it was negatived. The Chairman subsequently explained that there were 15,000 first shares still unissued, out of a total capital of £60,000. The Directors were authorized to endeavour to place them in any way they thought best; and if they succeeded, there would then be no necessity to issue debentures to Mr. Bower. Mr. Bower was complimented by several shareholders on his outspoken statements with regard to his position; and after the usual vote of thanks, the meeting separated.

THE INCREASE IN THE PRICE OF GAS AT BARNSLEY.

The recent action of the Directors of the Barnsley Gas Company in advancing the price of gas from 3s. to 3s. 4d. per 1000 cubic feet, has aroused considerable indignation in the borough; and last Tuesday a meeting of consumers was held to consider the matter. The Chairman (Mr. W. Tune) pointed out that at Darlington gas was 2s. 3d. per 1000 cubic feet; at Lincoln, 2s. 8d.; at Newcastle, 2s. 1d.; at Wakefield, 2s. 6d.; whilst at High Green and Mortomley, about seven miles from Barnsley and nine miles from Sheffield, it was only 2s. 6d. When he knew that small places like these only paid 2s. 6d. per 1000 feet for gas, was it likely he would quietly pay 3s. 4d.? At Batley and Dewsbury it was 3s. per 1000 feet; whilst at Driffield it was only 2s. 10d. He pointed out that, as consumers, they were not called upon to consider what dividend gas companies should pay. In many other places, meters were supplied free; and the state of the meter, when the bill was made out, was entered on the account. Nothing of the kind was done at Barnsley. Meters, which only cost £2, were subject to a rent of 10s. per year. Another speaker advocated application to Parliament, if necessary, for powers to start a new gas company, and to make a thorough examination of the present Company's accounts. Other gentlemen addressed the meeting, all condemning the action of the Company; and then the following resolution was passed:—"That this meeting considers the action of the Gas Company in advancing the price of gas from 3s. to 3s. 4d. per 1000 cubic feet uncalled for, and pledges itself to use every legitimate means to oppose the same." A Committee was organized to make arrangements for drawing up a requisition to the Mayor to call a public meeting of the inhabitants at an early date to condemn the action of the Company, and encourage the introduction of the electric light. The Committee of the Barnsley British Co-operative Society, who rank among the largest consumers of gas in the town, have decided to invite tenders from three electric lighting companies for putting down plant at their central stores to light all the departments. For the year ending June 30, the Society paid £562 for gas, including £21 for the rent of meters alone. It is estimated that the coming increase in price will entail an extra expenditure of from £60 to £70 a year; hence the action of the Committee.

ELECTRIC LIGHTING SCHEMES IN THE METROPOLIS.

At the Meeting of the Commissioners of Sewers of the City of London last Tuesday (the first after the recess), a desire was evinced by many of the members to proceed further in the matter of the tenders for electric lighting, the consideration of which had been adjourned from the 30th of July last (*ante*, p. 265). On Mr. Rose Innes being called upon to resume the debate, the adjournment of which he had moved, he simply remarked that he had nothing further to say on the matter. The Chairman (Mr. E. Manners) explained that at the last meeting before the recess, the Streets Committee presented a report on the electric lighting question; and a motion to agree with it was made. To this an amendment was brought forward to print the report, and circulate it among the members; its consideration to be adjourned in the meantime. This amendment was lost, and the report adopted; and the amendment could not be put over again. Mr. Innes said his proposition was to refer the report back to the Streets Committee. Mr. Day (Chairman of the Committee) asked what part of the report was to be reconsidered. The Chairman said the whole of it. On being put, this proposition was not agreed to. It was then moved to agree with the Committee in their report. To this an amendment was submitted by Mr. King, that the report should be printed and circulated. The Chairman said he had taken the opinion of the highest authorities on this matter, and such an amendment as that proposed could not be allowed. After a few more observations, the debate was again adjourned. Mr. Pannell thereupon remarked that they would come to a deadlock if they could not have the report printed and circulated. A report like the one in question could not be properly debated unless it had been in the members' hands for perusal and study. Perhaps the officers would say if there was any way by which the report, in some form or other, could be got into the hands of the members as speedily as possible, as he did not want the electric lighting question to stand over for four or five months. The Chairman said it had been decided to adjourn the debate, and therefore nothing connected with electric lighting could be taken. Mr. Pannel asked if it would not be competent for them to ask the Engineer (Mr. W. Haywood) and Mr. Preece to give their views on the report. The Chairman said nothing more could be done in the matter at that sitting. The subject then dropped.

A Special Meeting of the Paddington Vestry was held last Tuesday, to consider the report made to them on the subject of the electric lighting of the parish, and epitomized in the JOURNAL last week. Mr. Minchin proposed that in the interests of the ratepayers the Vestry keep the supply of electric lighting for Paddington in their own hands; and in order that such work might be carried out, a sum not exceeding £50,000 should be raised on the security of the lighting rate. He pointed out that for the amount indicated, the Vestry could provide 100 arc and 10,000 incandescent lights; and such important thoroughfares as Bayswater Grove and Harrow Road could be lighted by electricity. The incandescent lights could be supplied to private consumers, and the cost would be £17,000 a year; but the revenue derived from the sale of the light would be £29,000 a year. A rate of ¼d. in the pound would be sufficient for the raising of the money required. Mr. Judge (Chairman of the Electric Lighting Committee) proposed, as an amendment,—"That, inasmuch as the Electric Lighting Committee has not seen its way to recommend the Vestry itself to undertake to provide electricity, it is desirable that steps be taken to secure its being done at an early date by private enterprise, under a Provisional Order approved by the Vestry; and that such Order should embody a clause to the effect that the Vestry should be entitled, at the end of 21 or 31 years, to purchase the undertaking." Mr. Mills seconded the amendment; and Mr. R. F. Whur, who supported it, observed that a great many of the ratepayers were against the Vestry undertaking the supply. Colonel Blair, R.E., said he was strongly opposed to the Vestry furnishing the electric light. It was not their duty to do the work; and he could not trust them with the management of such an undertaking. The amendment was eventually carried by a large majority.

THE LEEDS CORPORATION AND ELECTRIC LIGHTING.

A Meeting of the Leeds Electric Lighting Committee was held yesterday week, when the question of the Corporation establishing a system of lighting by electricity in the borough was considered. The matter was discussed at the July meeting of the Council (*ante*, p. 85), on the resolution of Mr. Lee Hardwick, who moved—"That the Council apply to the Board of Trade for a Provisional Order under authority of the 'Electric Lighting Acts, 1882 and 1888,' authorizing the Corporation, as the Local Authority under the Acts, to provide and supply electricity for public and private lighting purposes within the area referred to in the report, at an estimated total capital expenditure of £68,000; and that the Town Clerk, in conjunction with the Electric Lighting Committee, be authorized and empowered to take all necessary legal and other proceedings, and to give notices on behalf of the Council which may be necessary in connection with the application to the Board for the obtaining of such Provisional Order." It was, however, decided to refer the matter back to the Electric Lighting Committee for further consideration, and to obtain additional information. This information has now been obtained, and was laid before the Committee at the meeting yesterday week. The matter was discussed at length, with the result that the above resolution, together with a report, will be introduced at the meeting of the Council to-morrow. The report gives particulars of the annual cost of the existing Corporation installation of electric lighting, and also as to the cost of the light in certain boroughs where it is in operation. As the present installation in Leeds is in an unfinished condition, no definite figures, says the report, can be given; but when the whole is completed, there will be about 3000 lamps installed at a cost of £7450. The annual cost will then be £2605, made up as follows:—Depreciation, 7½ per cent., £558 15s.; interest and sinking fund, 5 per cent., £372 10s.; wages, £280; fuel, £267; water, £78; oil and waste, £72; lamp renewals, £730; repairs, 2½ per cent., £186 5s.; removing ashes, £60—total, £2605. This is equal to 0·208*d.* per hour, or less than ¼d. per lamp per hour. The inquiries made in other towns show that in Sheffield, Taunton, Eastbourne, and Brighton, local electric lighting companies are supplying electricity for lighting streets or shops and houses; while at Nottingham "several are threatening to come." The Sheffield Company charge their consumers £20 for arc lamps (with a reduction on a quantity), and 8*d.* per unit for incandescent lamps, of which 600 are in use. The Taunton Company supply 65 arc and 200 incandescent lamps; the charge varying according to the time burnt, &c. The Eastbourne Company charge £30 per annum for the 16 arc lamps on the Parade; and the Brighton Company, who supply 40 arc and 3537 incandescent lamps, charge at the rate of 10s. per unit for the first 100 hours' consumption of the maximum supply demanded, 7s. 6d. for the second 100 hours, and 5s. for any further quantity consumed. Inquiries made show that Blackburn, Blackpool, Leicester, Manchester, and Oldham contemplate applying to Parliament for Provisional Orders to enable them to supply electricity for public and private lighting purposes; and that Birkenhead, Bolton, Cardiff, Chesterfield, Croydon, Gateshead, Hull, Rochdale, and West Ham have the matter under consideration. Bradford has already a Provisional Order, and an installation "successfully in operation." Brighton, which has had an Order since 1883, is considering the expediency of exercising its powers. Its Corporation has an installation of 800 lamps in the Pavilion. Bristol has a Provisional Order, and contemplates applying for an amending Order. At Colchester a Company obtained authority over a limited area, and for a time fulfilled the obligations of the Licence; but has ceased altogether to supply electricity. Huddersfield would have applied for a Provisional Order before, but intends asking for power in an Improvement Bill next session. At Liverpool, a Company have obtained an Order covering the most important area of the city. Salford has decided to apply for a Provisional Order. Swansea obtained an Order last session.

THE PUBLIC LIGHTING OF MOTTINGHAM.—At a public meeting held at Mottingham—or, as the rising district is now called, West Chislehurst Park—last Friday evening, to consider the question of adopting a system of public lighting, it was stated that the South Metropolitan Gas Company would supply light for eight months at the rate of £2 10s. per lamp. After some discussion, it was resolved to adopt a system of lighting by gas; and a Committee was appointed to carry out the details.

THE AGITATION AMONG GAS STOKERS.—A largely attended meeting of gas stokers and workmen was held at Richmond on Sunday, the 22nd ult., for the purpose of concentrating their forces in support of a demand made upon the Directors of the Richmond Gas Company for a reduction in the number of retorts from 90 to 72, and the adoption of the eight-hour system, with certain other advantages. It appears that the Directors have offered time-and-a-half for Sunday work with a week's holiday in summer; but have declined to concede the other demands. If this decision is not altered after reconsideration, the men will probably give in their notices. No dissatisfaction was expressed at Mr. T. May, the Company's Engineer, who was characterized as a "gentleman." It was decided to form a branch of the Gas Workers' Union.

THE SANITARY CONGRESS AND EXHIBITION AT WORCESTER.

The Annual Congress held under the auspices of the Sanitary Institute was opened last Tuesday at Worcester, together with a small exhibition of hygienic and other apparatus. The Mayor of Worcester (Mr. Alderman E. Day), accompanied by his civic brethren and several local notabilities (including Earl Beauchamp, who is the Lord Lieutenant of the County, and Dr. Gott, the Dean of Worcester), received the President, Mr. G. W. Hastings, M.P., and the members of the Institute at the Guildhall, and afterwards entertained them to luncheon. Subsequently, the company adjourned to the Skating Rink, where the ceremony of inaugurating the exhibition was performed by the Mayor of Worcester. The exhibits were divided into five classes, of which only two had any bearing upon the great industries with which our readers are associated. In Class 2 were shown apparatus used in the distribution of water and miscellaneous sanitary goods; and Class 3 was devoted to heating and cooking apparatus, smoke-preventing appliances, lighting, ventilating gas-burners, and ventilators. In the course of the proceedings at the opening, the Chairman of the Committee of Judges (Mr. Rogers) read the list of their awards. Therefrom we learn that Messrs. Joseph Cliff and Sons, of Leeds, were awarded a medal and a certificate for the wares they exhibited. Messrs. Guest and Chrimes, of Rotherham, obtained a medal for excellence in the manufacture of water-fittings and a certificate for self-acting air-valves. The Defries safety lamp and petroleum cooking-stove (shown by Geoffrey Harrison, of Worcester) received respectively a medal and certificate. There were a large number of exhibits as to which the judges were unable to arrive at a decision without a more elaborate trial than could be given at the exhibition; and among those selected for further tests in London were Caink's automatic gas governor and pressure reducing valve, shown by Messrs. Guest and Chrimes; the Stott-Thorp reflex sunlight, exhibited by Messrs. Stott and Co., of London; Stott's gas governor, shown by Mr. James Stott; and Fletcher's gas instantaneous water-heater, and the Fourness regenerative gas-lamp, from the display of Messrs. J. Ward and Sons, of Worcester. Three silver cups were offered by the Worcester Gas Company for the best gas-stoves exhibited under the following classes:—1. For the best gas-stove or gas apparatus for cooking purposes for families, including a sufficient supply of hot water. 2. For the best gas cooking-stove for an artizan's family. 3. For the best and most economical open gas-fire. The following competed for the special awards: Messrs. W. Bennett and Co., of Worcester; Messrs. H. and C. Davis and Co., of London; Messrs. Freeman, Emery, and Co., of Birmingham; Mr. G. Harrison, of Worcester; Messrs. Siddaway and Sons, of West Bromwich; Mr. W. Unsworth, of Warrington; Messrs. J. Ward and Sons, of Worcester; Messrs. C. Wilson and Son, of Leeds; Messrs. J. Wright and Co., of Birmingham. The names of the successful competitors have not yet been published.

There was not a large attendance of the members at the Guildhall on Tuesday evening to hear the inaugural address of the President, who prefaced it by saying that it would be affectation on his part to pretend, after his long connection with the Social Science Association, whose records were a perfect storehouse of sanitary information, and after having been for seven sessions a member and for three sessions the Chairman of the House of Commons Standing Committee on Bills dealing with sanitary matters, that he had no practical acquaintance with sanitary problems and sanitary work. He therefore proposed to deal with one or two sanitary questions on which he might claim to know something. There were many influences on the state of public health in this country which, in dealing with the question, they were bound to consider; and it was the consideration of these things which would lead them to determine by what means the public health could be best preserved. One of the greatest of these influences was that of habitation, which was much wider in its significance than most people commonly believed. The provision of efficient drainage was also a much wider matter than the public at large imagined. Some people thought that all that was required was to lay a drain and the thing was done. They had to consider in dealing with the drainage of a town what was to be done with the sewage. In times past, the nearest river or stream was considered the natural receptacle for everything carried away from a town; but they were, he hoped, beginning to understand better things, and to see that the very last places into which they should turn their sewage were those streams which were intended to afford health and pleasure to those who looked upon and drank of them. The recently enacted Local Government Act had given considerably greater facilities for the prevention of the pollution of rivers and streams than existed before; and if the County Councils used these powers firmly and efficiently, he could not doubt that a very considerable improvement in the condition of rivers and streams would take place. In Worcestershire neither the Severn nor the Teme were unpolluted; and it would rest with the County Council to exercise the powers which the Local Government Act gave them, and to say that this pollution should go on no longer. The County Council had already approached the Councils of Salop, Hereford, and Montgomery, asking them to unite with the County Council of Worcestershire in forming, as the Act empowered them to do, a Joint Board for the purpose of preserving these streams from pollution throughout their whole length; but so far this action had been without result—not one of these counties being found willing to join with Worcestershire in the good work suggested. He could only hope that wiser counsels would ultimately prevail, because, of course, it was useless for one county to take steps to prevent the pollution of a stream within its own borders if that stream was to suffer contamination from towns and counties above. Knowing that he was addressing a wider assembly than the County Councils he had named could be, he appealed through them to public opinion to say whether, when one authority was willing to save its streams from impurity, its efforts were to be thwarted by the reluctance of other counties to join in the good work. With regard to the vexed question of the disposal of sewage, he had a strong belief that the best way of disposing of town sewage was to let it flow direct in liquid form upon the land; and he recently had before him in the Committee of the House of Commons, to which he had referred, the case of the town of Reading, where this system acted most successfully and beneficially to the inhabitants. Mr. Hastings then proceeded to refer to the absolute necessity of employing only skilled, trained labour in the making of internal fittings and house connections with drains; and paid a tribute to the excellent work which was being done by the Plumbers' Company in London in taking care that men were properly trained and examined before being permitted to undertake this work, neglect in which might lead to endless trouble and disaster in households. He also dealt with the importance of thorough ventilation; and dilated on the importance of local authorities seeking enlarged powers in regard to sanitation. In conclusion, he spoke of the interest taken by the people of Worcester in sanitary matters. It was, therefore, hardly necessary to urge on them the importance of sanitation; but to those outside that meeting who might still be indifferent to these great works, he would venture to ask, "Is it well to do good or to do evil; to save life or to kill it?"

On Wednesday only one section sat—that of "Sanitary Science and Preventive Medicine." In addressing the members on "The Policy of Prevention in some of its Social and Sanitary Aspects," the President (Dr. G. Wilson, of Leamington), said that it was when comparison was made between the death-rates of districts in which the Sanitary Acts were intelligently and conscientiously carried out, and those of districts in which they were still practically ignored, that one could appreciate the enormous saving of life and prevention of human suffering which yet awaited improved sanitation. Even in the healthiest rural districts, the abominations of foul cess-pits or deep midden ash-pits polluting the air and endangering wells were still far too plentiful, while leaky drains were a constantly recurring source of nuisance. And these dangers to health were unfortunately perpetuated in respect to new dwellings, because the great majority of rural districts possessed no urban powers, and had therefore no control over the structural details of the dwellings themselves or of drains and closet accommodation. It was true that the Public Health (Water) Act insisted upon a proper water supply; but so long as there were no bye-laws to regulate those other important details, risk of nuisance and well-pollution would continue. These were questions which sooner or later must force themselves on the attention of the newly-constituted County Councils. It was no use disguising the fact that in the great majority of small urban and rural districts a do-nothing policy was still tolerated, if not encouraged; and this was mainly due to the fact that the unfair incidence in rating naturally enlisted the opposition of farmers and others to any village schemes of drainage or water supply from which they themselves derive no direct benefit.

A paper was read by Dr. Strange, the Medical Officer of Health for Worcester, in which he referred to the progress of the city in regard to sanitation during the past fifteen years. Twenty years ago, he said, the sanitary conditions of certain areas were about as bad as they could be. Describing the works which had been carried out to purify the city, he said that a new system of sewers had been laid; and an abundant supply of good water had been provided from the Severn. On his appointment as Medical Officer, he immediately recommended the authority to compel the provision of efficient drainage and the closing of surface wells in every house where the water was impure. Gradually the horrible privy nuisance was attacked and conquered; but at first little progress was made in this respect, on account of a pending injunction against Worcester by the towns lower down the river, who accused Worcester of polluting the river from which they, as well as Worcester, drew their supply of drinking water. It was a disgusting thing for any town or even house to do, to throw all its refuse into a stream from which human beings habitually drank. This, however, Worcester did, and was still doing, awaiting the time when experts should have agreed upon the best mode for the disposal of these matters, without creating a greater nuisance than the one it proposed to abate. They were assured by eminent chemists that all the dangerous elements of their sewage disappeared by oxidation before it passed sufficiently far along the stream to reach their next neighbours; but the idea of drinking even "converted sewage" was disgusting and offensive to all sensitive people. The water supply was constant and abundant; but, being drawn from the Severn, it was open to the charge of being more or less polluted by the drainage of many towns above Worcester, and, with regard to the possibility of neutralizing these noxious matters, opinions differed. Attempts had been made to secure other sources of pure supply, but so far they had failed.

A short discussion followed the reading of the paper. Dr. Carpenter, of Croydon, referring to the question of the best methods for disposing of sewage, said it was a mistake for an isolated country like England to allow the land to be permanently robbed. They ought to take care that the whole of the refuse produced by human beings should be restored to the land from which it was taken. Any destruction of these materials was, to his mind, a mistake in political economy. Dr. Swete, of Worcester, said the Severn was a really marvellous stream for the oxidation of sewage. It was really polluted from its source to its mouth; but it was a remarkable fact that four miles below Worcester, all traces of the sewage which the city put into it had disappeared; and when it joined the Teme below Tewkesbury, the water was actually clearer and purer than above Worcester. The causes of this rapid oxidation were unexplained. Some people said it was due to the animal life in the stream, and others that it was traceable to subterranean springs.

On Thursday, the section devoted to Engineering and Architecture opened its deliberations in the Guildhall with an address from the President (Mr. H. J. Marten, M. Inst. C.E.), who reviewed the progress of sanitation during the past 40 years. He began by alluding to what had been done in the draining of the Fen district, and to the increase in the acreage of tillable land, and the ameliorated condition of the place as a habitation, which had resulted. He next offered some remarks on the improvements which had been effected in town, village, and house drainage. Forty years ago, he said, the sanitary inspectors of what was then termed the Board of Health reported a most horrible state of affairs, which was now, happily, only exceptional—open stagnant sewers, leaky dumb wells, drains untrapped, through which at night, when all doors and windows were shut, the only supply of air for the inmates could be obtained; sewers, which were properly described as only elongated cesspools, and such like. Mr. (now Sir Edwin) Chadwick, as Secretary to the Board of Health of the period, received overwhelming obloquy in connection with sanitary matters. One of the great difficulties with which Sir Edwin then had to contend was the then existing idea that every sewer must be a *cloaca maxima*. This idea had been obtained from Rome; and it took a long while to disabuse the public mind of its truth. At length, however, the *cloaca maxima* was done away with; and the modern small-pipe sewer was introduced. It was a long struggle between the *cloaca maxima* principle and what was in derision termed the "pot drain;" but the latter eventually gained a complete victory. The question of the disposal of sewage next came under consideration; and Mr. Marten gave a history of the matter down to the present date. When the question between the *cloaca maxima* and pot drains was settled, and sewage flowed into the receptacles in increased quantities, the question of its disposal arose. Sewage farms were started; but, after several trials and various devices to meet the difficulties which arose, it was found that, on the whole, they failed to cure the evils which presented themselves. The last plan, which was now generally adopted, was to pass the effluent from the precipitating-tanks over a comparatively small area of land, and utilize the sludge as a sort of top-dressing to surrounding land. Attention was being directed to the discovery of some cheap precipitant that would render the effluent clear and bright, perfectly innoxious to fish life, good as an irrigant when so required, and incapable of secondary fermentation. He trusted that the sewage difficulty would soon, if it had not already, become a thing of the past. Water supply was next considered. Within his memory a large portion of the Metropolis was supplied with water from the Thames between Battersea and Vauxhall Bridges. Sir E. Chadwick and his medical staff, however, brought about a better state of things. The supplies given by the different Water Companies were on the intermittent system. But the constant system was adopted at Wolverhampton; and London now supplied 2,000,000 out of its 5,000,000 inhabitants thereon. He next gave a description of the new dam and water-works on the River Vyrnwy for

the supply of water to Liverpool. Having dwelt upon some of the improvements effected during the last 40 years in sanitary matters, he said the work that still remained to be done was of colossal proportions. He closed his address with a few remarks on the smoke nuisance, which he said was full of difficulties, and still awaited solution.

Papers were then read on "Sewage Disposal," by Professor H. Robinson, M. Inst. C.E.; and on the "Amines Process of Sewage Treatment," by Mr. Robert Godfrey, Assoc. M. Inst. C.E. Professor Robinson's paper specially alluded to the completion of sewage works at Kingston-on-Thames, where the Native Guano Company have undertaken the disposal of the sewage. The author said his feeling was that the "A. B. C." system, as worked out, produced the best effluent of any chemical system which did not employ filtrates in aid of chemicals; but the cost was a question to be looked at with the manurial value. He considered the time had arrived when an investigation by an impartial and qualified Commission into the question of sewage disposal would lead to useful results. The subject of Mr. Godfrey's communication has been so recently dealt with in our columns (see *ante*, pp. 447, 595) that further reference to it is unnecessary. The two papers were discussed together; Mr. Seller, of Leamington, bearing testimony to the success of the works at Kingston and to the importance of the Native Guano Company's products.

In the evening there was another meeting, when Sir Douglas Galton, K.C.B., delivered to a crowded audience an interesting address on preventible diseases. He pointed to the fact that, given certain conditions of impure air, impure water, and a soil saturated with filth, sickness and death from one or other of the diseases which were amenable to preventive measures would result. He quoted the following figures to show that zymotic diseases, which Dr. Farr had aptly called "filth diseases," have of late years been largely reduced by sanitary means. The deaths in England and Wales from these diseases per 100,000 persons living, which in 1861-70 were 425, were reduced in 1881-87 to 245; whilst in London the deaths, which in 1861-70 were 519 per 100,000, were reduced in 1881-87 to 313 per 100,000. Sanitation necessarily meant the increased well-being of the people; especially of the lower classes. Epidemics could only be prevented by making the whole population sanitary; and Sir Douglas gave some valuable advice on the subject of the conservation of the general health. He concluded by producing a number of statistics, showing what was really the meaning of "preventible" cause of death. A cordial vote of thanks to Sir Douglas was passed by the meeting.

On Friday, Dr. J. W. Tripe, Medical Officer of Health for Hackney, opened the proceedings in the section of Chemistry, Meteorology, and Geology with an address on the sanitary effects of special winds. A paper was next read by Mr. C. E. Cassall, F.I.C., F.C.S., on "The Extension of Public Analysis," in which he complained that the officials appointed to detect adulterations failed in their duty. Following this came papers by Dr. Percy F. Frankland on "Some Recent Results obtained in the Practical Treatment of Sewage;" and by Mr. J. W. Willis-Bund, on "A Suggested Standard for Effluents from Sewage Works." Dr. Frankland cited the cases of six towns with which he was familiar, and which might, he said, be taken as fairly typical in average performance of some of the best-managed sewage works in the country. The result showed that if the only object of the treatment is a fairly clear effluent, this could be satisfactorily attained by chemical precipitation. There would appear to be distinct evidence in favour of sulphate of alumina used in conjunction with lime. In no case, however, could any very great reduction in the proportion of dissolved organic matter be secured. The greatest success was to be anticipated by employing the maximum capacity in a single tank of moderate depth without partitions. Where not only a clear effluent but one as free as possible from dissolved organic matter was required, it was necessary to resort now, as heretofore, to the land. In such cases, however, the sewage should invariably be submitted to a preliminary process of precipitation. Mr. Willis-Bund, as Chairman of the Severn Fishery Board, suggested that the standard of purity should be that the effluent should be purified to such an extent that no effect would be produced upon the fish that frequented the stream into which the effluent flowed. Dividing the rivers of the country into those in which *salmonidæ* are found and those where they are not, he said that, curiously enough, up to the present time, with one exception, all sewage works had been placed on rivers from which *salmonidæ* were absent. York was the first case of sewage works being placed on a salmon river. Experience had shown that a river might be highly polluted, but still salmon would pass up if the pollution were diluted with a large body of water; and as salmon generally only ran up in floods, this was the usual state of things. But experience had also shown that if the pollution were concentrated the salmon would not face it. He thought that those who were interested in river pollution would be doing useful work by preparing a classified list of the rivers of England and Wales, showing the fish that inhabit them and the standard of purity required for them. As county councils had now some powers in the matter of river pollution, it would not, he thought, be asking too much of these bodies to prepare such a list, and ask the Local Government Board to enforce a minimum standard of purity. It was agreed to discuss these two papers together; but nothing very important resulted.

In the Engineering Section, Mr. R. F. Grantham, M. Inst. C.E., read a statistical paper on "The Water Supply of Great Towns." Comparing London, Liverpool, and Birmingham, he said that in the case of London the proportion of water drawn from deep wells and springs varies from about 13 to 15 per cent. of the whole supply. Liverpool, with a population of more than 600,000, at one time derived 6,250,000 gallons per day from deep wells, out of a total of nearly 18,000,000 gallons; the remainder being obtained from gravitation works. The supply, however, has been found insufficient; and the drought of 1887 was severely felt. Birmingham, in 1885, with a population of about 500,000, was supplied from deep wells in the new red sandstone at the rate of 9,000,000 gallons per day, and from streams at the rate of 7,500,000 gallons. The storeage capacity amounted to 617,761,913 gallons—equivalent to 10,000,000 gallons per day for 60 days, in addition to the daily supply. Birkenhead, with a population of about 83,324, derives an ample supply from deep wells, also in the new red sandstone. From the same formation, the South Staffordshire Water Company, who supply an area, about 40 miles in length, lying between Stourbridge and Repton, and about twelve miles in breadth at Lichfield, in 1869 obtained 10,000,000 gallons daily, and this was increased to 24,000,000 by driving a tunnel into the Keuper sandstone, marls, and pebble beds. Worcester, with a population of 40,000, is now pumping 1,250,000 gallons of water per day from the Severn, which, even in the longest drought, yields an unfailing supply. He remarked that where towns use river water for all purposes, chemists appear to be agreed that sand filtration is the most efficacious, as it is the least costly, method of purification on a large scale. Another paper in this section was on the "Technical Education of Plumbers as an Essential of Public Health," by Mr. H. D. Mathias.

The sectional proceedings were brought to a close with a service in the Cathedral, when the Dean (Dr. Gott) gave a brief address, in which he commented on the importance of the work done by the congress, and on the value of sanitary knowledge to the community at large. At six o'clock the final meeting of the Institute was held in the Guildhall—Mr. G. W. Hastings' presiding—when votes of thanks were passed to all who had promoted or taken part in the proceedings.

On Saturday excursions were made to Great Malvern and other places of interest in the neighbourhood of Worcester; and in the evening addresses to the working classes were delivered in the Public Hall, by Professor Corfield and other speakers.

THE AMMONIA INDUSTRY.

In an article on the above subject in a recent issue, our contemporary *Industries* referred to the importance which now attaches to the production of ammonia. It is pointed out that this industry, like many others, owes its existence to the necessity for removing a nuisance. The ammoniacal liquor of gas-works—an apparently useless and an offensive product of gas manufacture—had to be got rid of somehow; and this necessity led to the recovery of one of its constituents as a distinct business. But once established as a profitable commercial undertaking, for the produce of which there was a ready and an expanding market, the processes of recovering, in the form of sulphate, the ammonia contained in this product of coal distillation, were soon extended to other sources than that above mentioned. In this way, as well as in the development of the manufacture by improved methods of procedure, the industry rapidly grew, till now it has attained considerable magnitude. Hitherto its progress had been unobserved outside the circle of those immediately interested; but, from its present important position, it claims, and is beginning to receive, public attention. After these introductory remarks, our contemporary proceeds to give the following general facts and figures in regard to the ammonia industry.

Numerous and important as are the uses of the sulphate of ammonia, this substance is never made the object of direct manufacture. In all cases it is collected from the products of other manufactures formerly allowed to go to waste. Nor is it likely to be ever otherwise obtained; for we can hardly conceive of a cheaper source being discovered. Moreover, the present sources are inexhaustible; so that no necessity can arise to seek for others. Wherever coal is consumed in large quantities, there we have the raw material for the manufacture of sulphate of ammonia. At the present time the bulk of this substance is derived from the liquor of gas-works; and from that source we are likely to obtain our chief supply for some time to come. But besides this a large quantity is derived from the shale-works, in which a bastard coal is subjected to distillation for the purpose of obtaining petroleum oils and paraffin. Other sources, likely to grow in importance, are the blast-furnaces of the iron-works and coke-ovens. The gases from the former, instead of being allowed to burn in open flame, are brought down for use as a heating agent; but often, before being burned, the ammonia is separated from them. Still another source, likely to become of great importance in the future, is the producer of heating gas—the apparatus for the conversion of fuel into the gaseous form. The fact that a marketable product may be obtained from the waste gases constitutes one more inducement to large consumers of coal to adopt this system of conversion. Messrs. Brunner, Mond, and Co., of Winnington, in Cheshire, nearly cover the cost of the coal consumed on their works by the sale of the sulphate of ammonia recovered.

As there is no lack of the raw material to operate upon, so there is abundant room for further development in the processes of recovery. Great advances have been made in recent years, not in the discovery of new processes, but in the more skilful application of the old methods. Improvements in this direction have enabled works to more than double their production, while halving the expense for fuel. Hence the cost of production has been considerably diminished. Ten years ago the cost of making a ton of sulphate from gas liquor was about £15. Now the sulphate may be bought in the market for £12. The question how much sulphate can be obtained from a ton of coal is not easily answered. Much depends on the quality of the coal, and much also on the mode of burning it. The latter condition admits of little or no improvement; inasmuch as the coal is never, as before stated, burned for the sake of the ammonia. In gas-works, one ton of cannel coal will yield about 8 gallons of liquor; and, on an average, this quantity of liquor will contain sufficient free ammonia to form 0·8 lb. of sulphate. But this quantity is far below the possible yield of a ton of even ordinary coal. From Mond's gas producers (already mentioned,) the quantity of sulphate obtained amounts to 66 lbs. per ton of slack consumed; and this is said to be only half of what might, under specially favourable conditions, be gained. The plant erected at Winnington is sufficient to deal with from 200 to 240 tons per day of 24 hours, yielding from 6 to 7 tons of sulphate. Hence we see that the progress which is being made in this direction for economizing fuel—progress which is likely to be more rapid in the future than in the past—opens up a prospect of a greatly increased production of ammonia.

In the last decade the sulphate of ammonia industry has constantly and steadily developed itself; and considerable progress has been made in the last three years. A few statistics will show the vitality and present position of this young industry. The production in 1886 in the United Kingdom amounted to 106,610 tons; in 1887 it rose to 113,896 tons, to reach in 1888 a total of 122,785 tons. On the Continent the growth of the industry has been no less remarkable. The statistics of production in Germany in the last three years show a rate of progress similar to that which has taken place in this country. If we analyze the production of which the foregoing figures represent the totals, the result is equally satisfactory; for we find the increase under all heads. Thus we have in the years 1886, 1887, and 1888 respectively, from the gas-works, 82,480, 85,022, and 92,896 tons; from the shale-works, 18,080, 21,098, and 22,072 tons; from the iron-works, 3950, 5098, and 5280 tons; and from the coke-ovens, 2100, 2678, and 2537 tons. It is not easy to account satisfactorily for the slight falling off in the place of an increase in the quantity obtained last year from the coke-ovens relatively to 1887. Abroad, particularly in Germany, the production from this source has continued to increase; and greater attention is now being given to the blast-furnaces as a source of supply. Taking the market price of £12 a ton, the value of the sulphate produced last year in the United Kingdom is £1,473,420. The figures quoted indicate the growth and the present importance of the industry. A considerable export trade in sulphate of ammonia has sprung up. This, however, is likely to shrink away as the industry is developed abroad. In the first seven months of the current year, Germany imported 15,924 tons, of which more than three-fourths was derived from Great Britain. This quantity is considerably below that of the corresponding period of last year. The greater part of the sulphate produced is sold as a manure, for which use it is gradually growing in favour. The future of the ammonia industry is therefore closely bound up with that of agriculture in this country.

THE PROFITS OF THE COVENTRY CORPORATION GAS-WORKS.—At the meeting of the Coventry City Council last Tuesday, it was decided that £2808, the net profit for the year ending March 25 last, should be paid into the district fund by two instalments—Sept. 26, 1889, £1404; March 21, 1890, £1404.

EAST LONDON WATER-WORKS COMPANY.

The Directors' Half-Yearly Report.

The report of the Directors of this Company, which will be presented to the proprietors at their half-yearly meeting to-day, states that the revenue for the six months ending Midsummer last was £129,870, against £126,927 in the corresponding half year of 1888; being an increase of £2943. The expenditure for maintenance and management in the past six months was £50,113, against £48,724—an increase of £1389. The Directors think this statement satisfactory, and are gratified to observe that the various branches of industry in their district have lately shown signs of improvement. The quantity of water pumped in the period covered by the report was 7,265,664,142 gallons, against 7,182,563,971 gallons in the corresponding period of 1888. The new services laid on numbered 1859, against 1945 in 1888; the total number now in supply being 164,947. The quality of the Company's water left nothing to be desired by the consumers. There was an expenditure of £24,727 on capital account in the past six months, arising principally from the extensions in hand consequent upon concentrating the works at Lea Bridge (referred to in the report for the latter half of last year), which are being pressed forward with all practicable despatch. Two miles of new 42-inch mains have already been laid; and the sinking of the large wells at Walthamstow and Lea Bridge is progressing favourably. Though the difficulties encountered have been very considerable, the contractors are making every endeavour to hand the wells over to the Company at the earliest possible moment. In concluding their report, the Directors refer to the fact that the Bills affecting water companies which were introduced into Parliament last session, were either withdrawn or so modified as to justify the Directors in withholding further opposition. They recommend a dividend of 7½ per cent. per annum, which will absorb £64,521 out of the £79,697 available for division among the proprietors; leaving an unappropriated balance of £15,176.

THE ASSESSMENT OF THE MERTHYR LOCAL BOARD WATER-WORKS.

An appeal for a reduction of the assessment of the Merthyr Tydfil Water-Works was urged before the Merthyr Union Assessment Committee—Mr. R. H. Rhys presiding—last Saturday week by the Clerk to the Local Board (Mr. G. James).

Mr. James said that the appeal was in respect of the water-works within the parish of Merthyr, the gross estimated rental of which had been put down at £3710, and rateable at £2968. This the Board considered was exorbitant, having regard to the net annual value and to the sum at which they were assessed for other portions of their property in Llanfrechan, Llanditty, and Llanigan parishes, in the Brecon Union. The total receipts last year were £5700; and taking this basis, he contended that they had to ascertain what a hypothetical tenant would be likely to give, and to find by this process what the rateable value should fairly be Mr. J. Thomas, the City Surveyor of Bristol, had been good enough to assist him in working out the figures. After setting aside, as part of a sinking fund, what might be considered extra expense on account of unforeseen work which had to be carried out at the reservoirs, they must add something to the £5700, as the hypothetical tenant would be entitled to charge for water used for flushing sewers, watering streets, and for water used by the School Board. It appeared that 3 million gallons were so used in the year; and this, at 6d. per 1000 gallons, would represent £75—making in all £5775 as the gross receipts for the year. But they paid in salary £381, which Mr. Thomas said was really less than the hypothetical tenant would have to pay. Then there was another sum of £117, commission for the collector, and £29 was set down for stationery, and £18 for legal charges. For establishment cleaning there was £18; for repairs, £1084, of which £253 was paid in wages, which the hypothetical tenant would be bound to pay if he were to carry on the concern. Altogether these sums came to £1647; and after this was deducted from the £5775 (gross receipts), a balance of £4128 was left. They must take out what the hypothetical tenant ought to receive as his profit—say, 10 per cent., £577—and that would bring the balance down to £3551. Then, on account of corrosion of pipes, &c., there should be some allowance for the renewal fund. They carried on their renewal fund for 60 years at 4 per cent.; and taking out £336 on this head, the balance would stand at £3215. Then they would require 4s. 5d. in the pound for taxes (£591), which left an annual income of £2624; and this, Mr. James said, was the actual amount at which they ought to be assessed on the whole, and for Merthyr *pro ratâ*, £1240. The cost of the works was £141,800, of which £74,800 had been spent in the Brecon Union.

Mr. *J. Thomas* generally corroborated Mr. James's statement. Replying to questions, he said that £4128 as gross annual value would include landlord's and tenant's interest before there was any deduction from taxes. He considered the tenant's capital should be from £1500 to £1700 in cash. If the rates were not collected in advance, the proportion of capital would require to be greater.

Mr. *Harvey*, Surveyor to the Merthyr Local Board, was examined more particularly as to the Noyadd reservoir. It cost, he said, £35,000, and was constructed to store 80 million gallons.

The Chairman said this was a very important matter; and he did not think it was possible to settle it that day. They were asked to reduce the assessment from £3710 to £1240; and they could not possibly come to that conclusion without themselves consulting an expert.

It was decided that the Committee should adjourn the further consideration of the question for one month, and that application be made to the Board of Guardians for leave to call in the services of a valuer for the water-works of the Union.

SHREWSBURY CORPORATION WATER SUPPLY.

The Proposed New Works.

In the Journal for the 17th ult., we referred to the decision come to by the Shrewsbury Town Council in regard to the provision of an augmented supply of water for the borough—a subject which has for some time engaged their attention, and on which they consulted Mr. Baldwin Latham, M. Inst. C.E. The matter was so far settled at the meeting of the Council on the 9th inst., that the Town Clerk was instructed to give the necessary notices of the intention of the Corporation to apply to Parliament for power to carry out the scheme of a new river supply recommended by that gentleman. Mr. Latham investigated exhaustively the questions submitted to him; and presented to the Council a voluminous report thereon. The chief features of this document were laid before the members in a report by the Gas, Water, and Lighting Committee; and from this we extract the following particulars. Mr. Latham dealt with his subject under six heads: (1) Direct gravitation works from rivers and streams; (2) impounding flood waters; (3) pools in the neighbourhood of the borough; (4) supply from wells; (5) improving existing works; (6) new river works. These six schemes were all fully considered by Mr. Latham, with the result that they were narrowed down to two—a gravitation scheme, and a new river scheme. No less than eleven of the former schemes were brought forward in the report; the best of them being the Castle Pulverbatch scheme, estimated to cost £59,200. This scheme, assuming that the money could be borrowed for 30 years, would have cost £3219 per annum; and adding £200 a year for maintenance, would have brought the annual cost to the borough up to £3419. This estimate was liable to be increased by the cost of a service reservoir on some elevated spot near the town, rendered necessary in consequence of the present mains not being sufficiently strong to bear the pressure of the water direct from the Pulverbatch reservoir, at the height of upwards of 600 feet. The estimated cost of the river scheme, however, was £30,000; and repayment of this sum in 30 years would amount to £1631 per annum. In addition to this amount there would be the cost of pumping, including maintenance, £980; and filtration, £133—making together £2744, or £675 less than the estimated cost of the Pulverbatch scheme without the service reservoir. In regard to the quality of the water, the river scheme, according to analysis, had the advantage. Mr. Latham reported upon these two schemes in the following terms:—"The Pulverbatch works would certainly be of a more durable character than the pumping works; and if it was found that money for the machinery could not be borrowed for repayment in 30 years, and that for the works at Castle Pulverbatch the money could be borrowed for repayment in 50 years, then the Pulverbatch works would be the more economical. There is one great advantage the gravitation works have over the pumping works, and that is the increase of pressure of the water, and that the water is very much softer than the proposed river supply. On the other hand, there is a greater certainty that the supply from the river will always be abundant. Carefully weighing all the advantages and disadvantages, I am of opinion that the new river supply will be the most economical, and will prove a wholesome supply; and on these grounds I should recommend its adoption for the town of Shrewsbury." In making this recommendation, Mr. Latham said it must be understood that the new intake was to be located at such a point in the river as to be out of the reach of eddy currents that might bring sewage impurities back to the site selected for it. The Committee carefully considered these two schemes, and decided on recommending the latter, for the following reasons:—(1) That it would cost less by £30,000 in the construction; (2) that the analysis of the water showed it to be of better quality than that of the Pulverbatch scheme; (3) that the works required would be within the borough, and their rating would therefore be a benefit to the borough; (4) that it had been thoroughly tested as to cost, and its details were not a matter of conjecture or uncertainty. In coming to this conclusion, the Committee did not lose sight of the fact that the gravitation scheme had many natural advantages; and if the community to be served were of larger dimension, such as Liverpool or any other populous borough, they would not have hesitated to advise the larger expenditure. But looking at the prospects of the future, and the many other important works which might have to be carried out for the benefit of the borough, and the detriment to these which so large an expenditure as that contemplated by the gravitation scheme would entail, they thought the scheme they recommended for adoption was one that would be more beneficial than any other, and when added to the present conduit service would place Shrewsbury in a first-rate position as regards its supply of water, without any increase of rates in the borough.

THE WATER SUPPLY OF READING.

The members of the Reading Corporation have now under consideration the question of extending their water system; and in accordance with the instructions of the Council, Mr. James Mansergh, C.E., has prepared a report dealing with the present supply, and proposed new sources. The document, which is very lengthy, has been published in the local press; and we give the main features of it. The number of people at present supplied may be taken, it is said, at 64,000. The quantity of water disposed of for purposes other than domestic is about 760,000 gallons a day, and the domestic supply is 1,040,000 gallons, which, divided by 64,000, gives a little more than 16 gallons per head for domestic and 12 gallons per head for trade purposes per day. In very hot dry weather the consumption occasionally runs up to 2,300,000 gallons a day. As to future requirements, in considering an improvement of the works the Corporation ought to look ahead at least 15 years; and assuming that the future rate of growth will be only 30 per cent. in 15 years, and not 10, the population to be supplied in 1904 will exceed 83,000, and, at 28 gallons per head, will require 2,324,000 gallons a day on the average, and not unfrequently 3,000,000 gallons in summer. Before discussing the details of alternative sources, Mr. Mansergh states shortly what improvements he considers necessary in the present works in order to bring them into such a state of efficiency as is worthy of a thriving town of the status of Reading. (1) The first *desideratum* is the provision of storeage tanks above the filters, holding at least 15 millions of gallons. (2) Then he thinks it is abundantly manifest that really efficient filter-beds ought to be constructed. (3) Service reservoir accommodation for ten million gallons at such an elevation as will command the highest parts within the limits of the district of supply will be required; and also a pumping-station. The pumping machinery would have to be steam-driven; and three engines should be erected, any two of which would pump the maximum daily quantity at fair working speed, whilst the third would be kept in perfect working order as a "stand-by" in reserve. The dead lift from the pump wells to top water of the service reservoir would be 170 feet. In order to pump 3 million gallons in 20 hours, including friction in the main, would require two engines developing 76-pump horse power each; so that the total power to be installed would be 228-horse power. From the pumping-station the water would be pumped through about a mile of 26-inch cast-iron pipes to the service reservoir at Tilehurst. This reservoir Mr. Mansergh proposes to locate on the ridge between the Thames and Kennet Valleys. It may be made open, but in such a way that at any future time it might be covered if thought desirable. It should, he says, be built of concrete and brickwork, and made water-tight by such means as the nature of the ground may suggest. In order to provide effectually for the high-level districts, he suggests that the tower and tank at Whitley should be raised about 30 feet, and that the tank now in Bath Road should be removed, and re-erected on a tower 50 or 60 feet high alongside the intended Tilehurst service reservoir. Low and high level mains would have to be laid. Proceeding to discuss the alternative sources that are available, Mr. Mansergh says that, in Reading, there is no opportunity of obtaining such a supply as is furnished to many of the north country towns by the high unpolluted moorlands of the Pennine range or the Welsh and Cumberland mountains. If the river is deserted, the only alternative is to procure a supply from the rain which has fallen upon the chalk or greensand outcrops to the north and west, and is stored in the fissures and interstices of these underground rocks. Upon the geology of the district, he remarks, the Corporation have obtained a report from Mr. J. H. Blake, F.G.S. His opinion is that a supply should be procured from the upper greensand, which underlies the chalk in this neighbourhood at a depth varying from 300 to 700 feet. Mr. Mansergh has no doubt at all that the water procurable from that source would be of excellent quality; but he has grave misgivings as to the quantity obtainable. Instead of proposing the greensand, he recommends the establishment of works for obtaining a supply from the chalk, and possibly the upper greensand, at a spot within the north-

western corner of the borough, and adjoining the Great Western Railway, and which he calls the Norcot source. Mr. Mansergh enumerates the advantages of this site, and then continues: "I should propose to acquire about 10 acres of land for the works and the right to drive headings at right angles to the dip of the beds under other lands. By pumping from these headings, the water from the upper chalk with flints would be tapped, and its outflow into the bed of the Thames prevented. In the estimate I have provided for 4000 feet of headings; but a less length than this may suffice to produce all the water required. As, according to Mr. Blake's report, I judge that the top of the upper greensand would be found here within 400 feet of the surface, it would be a simple matter to put down a boring or two in the hope of adding to the chalk supply some softer water from that formation. From the chalk and the greensand together, I have little doubt that an ample quantity is procurable. The whole of the works here would be very simple. The pumping machinery would be arranged to raise the water from the wells, and force it up to the service reservoir at Tilehurst, either at one or two lifts, as might be found most convenient. The power required could not be determined with accuracy until by trial borings the probable level of the water had been ascertained. It would, of course, be somewhat in excess of the 228-horse power worked out for the other side; but as against this there would be saved the expenses of the Southcot and Fobney stations, and as against the wells and headings in the Thames Valley, the construction of the storeage-tanks and filter-beds in the Kennet, and the expense of filtration. The rising main for the chalk supply would cost less than the others because the lengths from Fobney and Southcot respectively to the storeage tanks would be saved. The supply mains from Tilehurst to the town would be the same in both schemes. I have made an approximate, but what is I believe, a covering estimate of the cost of the works above described; and I will now set them out in sufficient detail for present purposes." Estimates of cost are then given by Mr. Mansergh. For Scheme No. 1 (for improvements of the existing works, taking water from the Kennet, 3 million gallons a day), he calculates, without going into every detail, that the several items of cost would amount to a total of £120,600; and that the annual charges under this scheme would be interest and redemption at 4½ per cent., £5427, and expenses of Fobney and Southcot stations and filtration, and pumping 2 million gallons a day £1950—making a total of £7377. For Scheme No. 2, the new supply from the chalk at Norcot (for taking water from the chalk and upper greensand in the Thames Valley, 3 million gallons a day), he reckons that the total expenditure involved would be £116,800; and the annual charges, interest, and redemption, £5256; pumping 2 million gallons a day, £2123—total £7379. Before closing his report, Mr. Mansergh advises very strongly, that, if the Corporation determine to obtain a supply from the chalk, the most approved works possible for the softening of the water should be erected.

Huddersfield Corporation Gas and Water Supply.—At the last meeting of the Huddersfield Town Council, the minutes submitted by the Gas Committee stated that the Executive Sub-Committee had decided, in addition to the reduced charge for gas for motive power, bakeries, and cooking purposes, to reduce the price to 2s. per 1000 cubic feet for heating purposes. The Water Committee reported the profit for the year ending Aug. 31 was £2027. The minutes of both Committees were adopted.

Leicester Corporation Water Supply.—At the meeting of the Leicester Town Council last Tuesday, the Water Committee reported that the accounts of the water undertaking for the six months ending June 30 last showed a net profit of £7122. Out of this sum, £1961 has been added to the sinking fund; leaving £5161 at the disposal of the Council. Mr. Hollingworth, in moving the adoption of the report, said that at present the number of persons supplied with water in the borough was 176,000, as compared with 167,050 a year ago. The reservoirs were in good order; and there were 500 million gallons of water in store. Considering that they were not delivering water to the full extent of their capacity, and that in November next they were going to ask Parliament for powers to go to another watershed, their profits were not likely to be continued. The report was adopted.

The Grievances of Bradford Gas-Workers.—A public open-air meeting was held at Bradford last Saturday week, to receive a report of a Sub-Committee of the Bradford branch of a body called the "Labour Electoral Association of Great Britain and Ireland," with regard to the grievances of the stokers employed at the Bradford Corporation Gas-Works. The men, it appears, complain that, although working under the system of eight-hour shifts, they are compelled to do as much work as is done under the twelve hours' system. Another complaint is that each man is called upon to produce 26,000 cubic feet of gas; whereas the average in other towns is much below this. Then they say that they are compelled to work seven days a week, and that they receive no overtime for Sunday labour. They would prefer to have Sunday work abolished. The last grievance is that, whilst they have twenty retorts to attend to, they have also to look after three low fires, to get their own coals, and do their own scurfing; whereas the men at the Leeds Gas-Works and in other towns do neither the "scurfing" nor the coal trimming. One of the speakers stated that the ratepayers of Bradford were the actual employers of the men engaged at the gas-works; and it behoved them as fair-dealing men to see that their workpeople were paid fair wages, and that they laboured under fair conditions. At present this was not the case, as the statement of the gas-workers showed. A resolution was passed, asking "the ratepayers to consider carefully the statements made, and to insist that all genuine grievances shall be remedied."

The New Water-Works of the Bradford Corporation and the Knaresborough Local Board.—Last Tuesday a deputation from the Bradford Water-Works Committee, accompanied by the Mayor, the Town Clerk (Mr. W. T. M'Gowan), and the Engineer (Mr. A. R. Binnie), had an interview with the Knaresborough Local Board on the question of the proposed extension of the Bradford Water-Works, especially with reference to the future supply of water at Knaresborough. The works contemplated to be carried out in Nidderdale by the Corporation were explained to the Board by the deputation; and it was pointed out that in their opinion their construction would not only increase the quantity, but improve the quality of the water sent down the Nidd as supplied to the Knaresborough Water-Works, but would also cause a more equable flow down the stream throughout the year, and prevent a scarcity in dry weather. Compensation reservoirs are to be provided two miles above Pately Bridge, the repair and maintenance of which will be borne by the Corporation to satisfy the Board and riparian owners on the course of the Nidd, where a large area will be devoted to gathering purposes and for storing. The discussion was continued for an hour—the Local Board being anxious to protect their future supply. The deputation left on the understanding that the Board would consider the proposals, and then communicate their requirements to the Corporation; the scheme being evidently viewed by the Board as likely to have an injurious tendency by affecting the purity of the water.

NOTES FROM SCOTLAND.

(FROM OUR EDINBURGH CORRESPONDENT.)

Edinburgh, *Saturday*.

The Edinburgh Gas Commissioners will hold on Monday their first meeting after the holidays. They will have before them the reports by their Engineers, which show that in August there was an output from the Edinburgh works of 37,961,000 cubic feet of gas, an increase over the corresponding month of last year amounting to 2,825,000 cubic feet; and that the output from the Leith works was 20,321,000 feet, an increase of 1,756,000 cubic feet. It will also be reported that, on account of the very large increase of profits during the past year, the Assessor for Edinburgh has entered in the valuation roll the gas-works in his district at £49,091, an increase of £22,474 compared with the previous year; that the Assessor for Leith has increased his valuation from £4703 to £6656, a rise of £1953; and that the Assessor for Mid-Lothian has fixed the valuation of the Commissioners' property in the county at £1596, an increase of £970. This is one of the penalties which are paid on account of prosperity. The Commissioners expected that, under the clause in their Act of Parliament which requires them to fix the charge for gas at a rate which will enable them to meet the expenditure, and which debars them from accumulating profits, they might not be called upon to pay income-tax upon their profits. This view of the subject was not, however, taken by the income-tax authorities; and, to clear the matter up, the Gas Commissioners referred it to Mr. J. B. Balfour, Q.C., the Dean of the Faculty of Advocates. Mr. Balfour's opinion is that the Commissioners are liable to pay upon their profits; and, the Treasurer's return of the amount to be taxed during the current year amounts to £68,820. At Monday's meeting the Commissioners are to consider what position they are to assume in connection with electric lighting. The Works Committee recommend that they should refuse their consent to the three applications of which they have received notice. A motion is likewise to be submitted by Sir James Gowans, asking the Commissioners to consider whether retiring rooms and lavatory accommodation for the workmen should not be erected in both the gas-works. These subjects, with the question of whether they should allow discount to large consumers, ought to make up business enough for an interesting meeting.

The Gas Commissioners of Dundee resolved, at their meeting on Wednesday, to memorialize the Board of Trade for a Provisional Order, authorizing them to supply electric lighting for public and private purposes within the city of Dundee. If they succeed on that notice, their present industry is quite safe. They never will get the consent of a sufficient proportion of the inhabitants of the whole city to enable them to start an installation. Only in a restricted area can that permission be expected; and here, possibly, may arise a very serious difficulty in connection with the introduction of electric lighting by local authorities. If a company furnishes the light, they are entitled to supply it in one street, and not to supply it in another, according to their expectation of its paying them. On the other hand, a local authority, trading upon capital derived from the whole community, can scarcely escape the obligation to supply the light to all who ask for it—that is, in effect, to make the area of supply equal to the district they represent. The only way to avoid this would appear to be to frame conditions under which the inhabitants of the restricted area selected for the supply should bear the entire liability for the undertaking, including the risk of making good the deficit in case of failure. Upon that condition, I fancy it would be difficult to find the inhabitants even of a very restricted area willing to take an electric light supply from a local authority. The question enlarges when it is borne in mind that, in places such as Dundee, there is a considerable population within the area of compulsory gas supply, but without the burgh boundaries. These people are entitled to see that the Gas Commissioners do not prejudice their gas supply by the undertaking of risks which are for the advantage of only a very limited portion of the compulsory area. These considerations point in the direction of electric light supply being left in the hands of companies, the shareholders of which, furnishing the capital, undertake the whole liability. At all events, it savours of the high-handed, if a Gas Commission, situated as Dundee is, adopt, without the approval of their constituents, a policy involving such a new departure. The same remark would apply to Edinburgh and other cities. The question is large enough for decision by the ratepayers, and should be submitted to them at the forthcoming municipal elections. It ought not to be decided by a handful of Commissioners, who were appointed at a time when the question was not in existence.

Last Tuesday the Gas Committee of the Aberdeen Town Council had before them the plans, specifications, and estimates for the new stoking machinery which it is proposed to erect at the gas-works of the Corporation. To satisfy present requirements, an outlay of £5515 will be necessary; but if the new system is extended, the cost will be rather more than £6000. The Council have already sanctioned this expenditure; and the Committee resolved to recommend them to entrust the work to West's Gas Improvement Company, Limited, of Manchester.

In connection with the recent explosion of gas at Banff, the examination of the works and mains of the Gas Company, by Mr. A. Smith, Gas Engineer, of Aberdeen, was made last Saturday, in the presence of representatives of the Company and the Police Commissioners. The mains were laid bare for a pipe-length in five different parts of the town; and, besides a careful inspection, were tested by fire for escapes. No leakage was discovered, though some of the pipes are nearly 60 years old. But the soil is not unfavourable to the duration of iron; and it is not unreasonable to expect that the pipes are in good condition. There is in that part of Scotland, however, a great amount of traffic with traction engines—much larger than in Edinburgh; and as some of the pipes, particularly service-pipes, are near the surface, a number of them must necessarily have sustained injury by the heavy weights passing over them. In that view liability for leakage lies more with the road authorities than with the Gas Company. Mr. Smith's report, which was read at a meeting of the Directors of the Company on Thursday, stated that he found the pipes to be of sufficient strength, excellent quality, and the jointings gas-tight. He recommended that they should be relaid at a depth of 2 feet, to support the heavy traffic of the streets, and also that stopcocks should be fitted to the service-pipes. The Directors, in considering the report, recorded their satisfaction that the subjects referred to had been found by Mr. Smith to be in such admirable condition, and that there existed no ground whatever for the statements so widely and sedulously circulated of late among the consumers, that the distributing plant of the Company was in an untrustworthy, dangerous, and dilapidated condition; and the Directors resolved that the report should be communicated to the public.

The Works Committee of the Edinburgh and District Water Trustees have this week spent three days in examining the districts from which it is proposed to procure an additional water supply. Leaving the city on Wednesday morning, they inspected that day the Manor and Glenrath streams. Returning to Peebles the same night, they, on Thursday,

visited the Talla, the Fruid, and the upper waters of the Tweed. From Peebles on Friday morning, they drove through the rugged hill scenery of Peebles and Selkirkshires to St. Mary's Loch, round which they were conveyed, and that night they returned home. Messrs. Leslie and Reid, the Engineers to the Trust, accompanied the Committee, and explained to them the proposals made in their report of last winter, referred to in my "Notes" in the JOURNAL for Feb. 19 last. Stated briefly, the conclusion the Engineers came to was that from the Manor they could get 15 million gallons per day, and the cost would be £664,000; from the Talla, the yield would be 24 million gallons, and the cost £970,000; and from St. Mary's Loch, the yield would be 36 million gallons, and the cost £1,065,000. St. Mary's Loch (over which there was so much fighting in 1871, and which was then rejected in favour of the Moorfoot scheme) is the most costly of the three schemes. But it has the advantage of giving by a long way the greater quantity of water; and when the disappointment of the Moorfoot scheme is remembered, it may on that account be adopted. Bailie Archibald and Mr. Colston, at present the two leading members of the Water Trust, were both members in 1871, and fought stoutly for the St. Mary's Loch project. They were both present at the inspection this week, and are supposed to look once more with favour upon their "old love." The water derived from the Manor is, however, the best of the three in quality; and Bailie Archibald, it is known, is not insensible to that circumstance, which may lead to his valuable assistance being secured by the advocates of it in the event of St. Mary's Loch being considered too costly. The Talla scheme is likely to be dropped by the Committee; but, of course, the public might, in a strange whim, prefer it, and the Committee would have to yield. The Committee are to report on the schemes to the Trust, and will probably recommend one of them; but as there is no intention of proceeding with a Bill in the ensuing session of Parliament, it may be some time before their report is ready.

(FROM OUR GLASGOW CORRESPONDENT.)

GLASGOW, *Saturday*.

Mistakes will happen, even with the most careful correspondents. One occurred in my "Notes" of last week. By some unaccountable slip of the pen, I spoke of a new gasholder having been completed at the Saltcoats Gas-Works, whereas I should have mentioned Ardrossan instead. The two places are so very close together that it is difficult to speak of the one without in the "mind's eye" seeing the other; and that circumstance may, in some measure, account for the mistake of which I have now made a correction. All the same, Saltcoats will very shortly do what its neighbouring burgh has just done—it will "inaugurate" a new holder of its own.

This week the Glasgow Gas Trust's coal-purchasing Sub-Committee have settled a number of coal contracts in continuation of, or in supplement to, those that were made last May. It is understood that about 100,000 tons additional were regarded as being needed for carrying on the works till next September; and the tenders sent in only numbered some 40 or 42. Generally small lots of Lanarkshire cannels of the third class were bought at about 9s. per ton, which were offered last May at from 8s. to 8s. 3d. per ton; the price at the pits being something like 7s. per ton. Some of the splint coals are now 2s. per ton higher in price than in May—10s. to 10s. 6d. per ton being very general for shipping lots f.o.b. at Glasgow. Not much of this class of coal seems to have been purchased. What are known as Lanarkshire "pugs" were formerly bought at 6s. 6d. per ton or thereabouts. But they are now up as high as 9s. per ton; and it is said that all offerers of these have been left out in the cold. Overhead the purchases just made have been done at an advance of about 1s. per ton.

I am informed that the draft Provisional Order which it is intended to submit to the Board of Trade, asking powers for the Corporation to supply electric lighting in Glasgow, has received the last revising touches from the Town Clerk (Sir James Marwick). It has yet, I believe, to receive the sanction of the Corporation Gas Committee, and of the Corporation as a whole. Authority has been given to a Special Sub-Committee to meet and confer with Messrs. Muir, Mavor, and Coulson, or any other private firms of electricians who may desire to have a conference with them in view of the Provisional Order being applied for. It is evident that the Gas Committee are very decided on the question of retaining in the hands of the municipal authorities the business of supplying electric light within the city, as is the case in respect of gas and water. Of course, it is morally certain the actual work of "manufacturing" and distributing the lighting current will be let out on contract to one or more private firms.

The financial affairs of the Glasgow Gas Trust seem to be in a very healthy condition. When the annual balance-sheet was made up as at May 31, 1889, it was estimated that outstanding gas-rents might yield a sum of £40,879; and it turns out that up to Wednesday of this week (Sept. 25), there had been recovered not less than £45,862, or almost £5000 above the estimate; and additional payments are still being made.

At the last meeting of the Finance Sub-Committee of the Glasgow Gas Trust, it was reported that the Conveners of the Finance and Works Sub-Committees had examined and considered the results of the manufacture of gas at the various gas-works during the financial year ending on May 31, 1889, and that they had recommended that the following premiums be paid to the respective Station Managers for that period:—Dalmarnock Gas-Works (Mr. J. Manwell), £170; Dawsholm Works (Mr. David Terrace), £170; and Tradeston Works (Mr. Wm. Key), £150. The Sub-Committee approved of the report, and agreed to recommend to the Town Council the payment of the sums specified.

At a recent special meeting of the Glasgow Gas Committee, at which there was a very full attendance (the Lord Provost presiding), it was resolved to recommend that a sum of £350 be voted to Mr. Alexander Ross, out of the Superannuation Fund taken over from the Glasgow Gaslight Company, as a token of the Corporation's appreciation of his long and faithful services as Treasurer of the Gas Trust.

The Falkirk gas-supply district has of late made such great demands upon the Joint-Stock Gas Company's works that it has been found necessary to increase the storeage capacity to the extent of 250,000 cubic feet. During last winter a very large increase was made to the number of lights in the various foundries which give such a special industrial character to the district; and the united storeage of the two Gas Companies, which were amalgamated fully a year ago, has proved quite insufficient. Accordingly, a new concrete tank for a gasholder, having a capacity of 250,000 cubic feet, is being constructed on the site of the old Grahamston granary, adjoining the works. The tank measures 92 feet in diameter, and is 20 ft. 6 in. in depth.

An important scheme of increase of salary to the meter inspectors, collectors, and survey clerks of the Glasgow Gas Trust has been devised, and will be submitted for the approval of the Town Council at the next monthly meeting of that body. The increase in each case is to be as follows:—Meter inspectors, from £90 to £100 per annum; outdoor collectors, from £100 to £110 per annum; indoor collectors, from £150 to £165 per annum; survey clerks, from £100 to £110 per annum; the salary of Mr. B. M'Laren, the chief collector, to be advanced from £190 to £200 per annum. The Treasurer, as hitherto, is to be allowed the discretion to raise the salaries of the officials of the several departments to the maximum proposed to be fixed, from time to time as he may think proper and expedient.

Some transactions in gas stock on the Glasgow Stock Exchange have been reported this week. On Wednesday, business in the shares of the Partick, Hillhead, and Maryhill Gas Company was done at £5 5s. per share. On Friday the ordinary shares again realized the same price; and the preference shares produced £5 10s. per share, while at the close in the afternoon £5 10s. and £5 11s. 3d. respectively were wanted by sellers.

During the past week the Glasgow pig iron market has been strong and excited; and a large amount of business has been done in warrants at higher prices—the advance being the largest rise in one day for some time back. Yesterday the price of Scotch iron reached to within 4d. of 50s. per ton cash—Monday's price having been 47s. 9½d. per ton. In three weeks the price has gone up 3s. per ton; and the public are now dealing more freely in the commodity than at any period this year. The position remains very strong. Makers find the demand overlapping the supply, and some are practically out of the market as sellers. Canada has been buying at the top price; and America is making inquiries that will probably result in business.

The local coal trade continues to be active; and the exports are still of a very satisfactory nature. In the household sorts, there is an improving demand, owing to the return of colder weather. In some instances coal is not to be had readily, even at the advanced rates that are quoted.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 28.

Sulphate of Ammonia.—With rather more offering, the market is somewhat easier; and for October delivery the quotations are 2s. 6d. to 5s. per ton lower. There should not, however, occur any serious depreciation while the present demand for spot lots continues; and immediate parcels are as yet none too plentiful. The course of values during October will depend upon two main factors—viz., the quantities which will be brought on the market by manufacturers, and the quantities required by dealers to cover speculative sales. It is reported that the latter are extensive; while, on the other hand, only a very small portion of the English production seems to have been disposed of. To-day's prices range from £12 to £12 2s. 6d., according to delivery—Oct.-Dec. delivery offering at £12, f.o.b. Hull; and £11 17s. 6d., f.o.b. Leith. Nitrate is very dull, and slightly lower.

LONDON, *Sept.* 28.

Tar Products.—Considerable advance has taken place in most of these; and business during the week has been brisk. Prices may be taken as follows:—Pitch, 23s. 6d. to 25s. 6d. per ton. Tar, 22s. to 30s. per ton, according to position. Benzols (90 per cent.), 3s. 2d. per gallon; (50 per cent.), 2s. 3d. per gallon. Toluol, 1s. 5d. per gallon. Solvent naphtha, 1s. 6d. per gallon. Crude naphtha (30 per cent.), 1s. 2d. per gallon. Light oil, 3½d. to 4d. per gallon. Creosote, 2¼d. per gallon. Carbolic acid (60's), 3s. 5d. to 3s. 6d. per gallon. Cresylic acid, 10d. per gallon. Anthracene (30 per cent.), "A" quality, 1s. 1d. per unit; "B" quality, 11d. per unit.

Ammonia Products.—Sulphate of ammonia is in good demand at £12 to £12 5s. per ton. Prices: Gas liquor (5° Twaddel), 7s. to 8s. per ton, with a rise or fall of 1s. 6d. per degree. Liquor ammonia, 1¾d. per lb. Carbonate of ammonia, 3¼d. per lb. Muriate of ammonia, brown, £19 10s. per ton; white, £28 per ton. Sal ammoniac, £33 to £34 per ton.

SALE OF SHARES.—Mr. H. Cuthbert offered for sale at Brighouse, last Wednesday, thirty £10 shares in the *Elland Gas Company*, which fetched £23 10s. per share; ten £3 shares in the *Rastrick Water Company*, which sold, after much competition, for £7 per share; and seven £10 shares (£4 paid) in the *Rastrick Gas Company* for £10 11s. 6d. per share.

IMPROVEMENTS AT THE HALIFAX GAS-WORKS.—Since the appointment o Mr. Holgate as Manager of the Halifax Corporation Gas-Works, a good deal of important work has been done in connection therewith. The extraordinary leakage of a gasholder-tank will possibly be remembered by our readers. A new inner lift has been provided for the gasholder in question, and there is now no leakage whatever. A new scrubber has been ordered; and the Gas Committee are asking for tenders for more purifiers. A new bench of retorts is being put up, in view of a certain increase in the consumption.

THE BIRMINGHAM GAS COMMITTEE AND THE EIGHT-HOUR MOVEMENT—A meeting of the Gas Committee of the Birmingham Corporation was held on Monday last week to consider the report of the Sub-Committee on the question of the alteration of the hours of work for the men in the employ of the Gas Department. The Committee, after a long discussion, decided to concede to the carbonizers in their employ the eight hours' shift, without any reduction in wages, and with an equitable reduction of the work. The result arrived at will extend to more than 1000 men employed as carbonizers, and represents an extra charge upon the Gas Committee of £1500 to £1700 a year.

THE GAS EXHIBITION AT HASTINGS.—The exhibition of gas appliances held last week in the Public Hall, Hastings, was highly creditable to the Hastings and St. Leonards Gas Company, and to their Engineer and Manager (Mr. C. E. Botley, Assoc. M. Inst. C.E.), by whom it was carried out. The exhibits were supplied by Messrs. H. and C. Davis and Co., Messrs. T. Fletcher and Co., Messrs. H. Green and Son (Meteor lamps), Mr. J. C. Kenwood (Wilson's gas-stoves and Welsbach burners), Messrs. Liddiard and Wordley (Wenham lamps and Wilson and Leeds gas-stoves), and Messrs. W. Sugg and Co., Limited. The opening ceremony was performed by J. Brown, Esq., J.P., Chairman of the Company, in the presence of a numerous attendance. Having delivered a short address, in which he explained that the object of the Company was to show the public the various uses to which gas may be put in the several departments of lighting, heating, and cooking, he introduced Miss Ida Cameron, who gave a lecture on high-class cookery; following it, in the evening, with one on domestic cookery. This lady's demonstrations were continued on Wednesday, Thursday, and Friday, and were always well received. On Thursday evening Mr. Botley delivered to a large audience an interesting lecture on "The Uses of Coal Gas and the Sanitary Aspects of Gas Lighting," in the course of which he denied the statement made by Major-General Webber at the Health Congress held in the town a short time ago, to the effect that incandescent electric lighting presents greater advantages than gas from a sanitary point of view, and showed that the imaginary evils attributed to gas lighting arise from want of knowledge of its proper use—a matter on which he said the consumers had still to be educated. This was the Company's object in presenting to their notice the various appliances on view in the hall. The exhibition closed on Friday night.

THE KENDAL CORPORATION AND THE GAS AND WATER WORKS.—At the monthly meeting of the Kendal Town Council last Tuesday, Mr. Monkhouse moved that it was desirable that a competent Engineer should be appointed to report as to the probable results of a transfer of the gas and water works, early enough to admit of giving the usual parliamentary notices. The motion was agreed to.

THE NOTTINGHAM CORPORATION GAS DEPARTMENT AND BYE-PRODUCTS.—The *Nottingham Daily Express* understands that there is every probability of a speedy development in the manufacture of coal tar, pitch, and other carbonaceous products at the Nottingham Corporation Gas-Works in the neighbourhood of Ilkeston. The works at Giltbrook are being extensively utilized in this direction; and the supply of material for the shipbuilding yards at Hull and elsewhere is likely to become much heavier.

THE WATER SUPPLY OF JOHANNESBURG.—According to a cablegram just received by the London agents of the Johannesburg Water-Works Estate and Exploration Company, Limited, the Company, at their recent annual general meeting, decided to increase the capital to £185,000, for the acquisition of additional water rights, which, it is anticipated, will treble the present supply, and for payment of an over-draft at the bank. The extension of the works will be defrayed by debentures, instead of devoting the revenue to capital purposes.

SOUTHAMPTON CORPORATION WATER SUPPLY.—The Southampton Town Council, it will be remembered, recently decided to spend £800 in deepening the adits at Otterbourne. At the meeting of the Council last Wednesday, Mr. Cleveland moved that no action be taken in the matter until after the renewals of mains recommended by the Water Engineer (Mr. W. Matthews) are carried out. It appears that at present there is an enormous waste of water in the borough through defective mains; and Mr. Cleveland considered that, when the renewals had been made, the proposed expenditure on the adits would not be necessary. After a protracted discussion, the resolution was negatived.

ELECTRIC LIGHTING AT BLACKPOOL.—A special meeting of the Blackpool Town Council was held last Wednesday, to consider the advisability of obtaining powers to supply the electric light for public and private purposes in the borough. The Mayor (Mr. J. Fish) moved a resolution to the effect that application be made to the Board of Trade for a Provisional Order authorizing the Corporation to supply electricity for any public and private property in the borough. His Worship said the object of putting the motion to the Council was simply to prevent outside companies from stepping in and obtaining powers the Corporation themselves ought to have. The motion was carried unanimously.

THE DARWEN CORPORATION WATER-WORKS.—A Committee of the Darwen Corporation met the Water Committee of the Blackburn Corporation last Wednesday, when the question of the purchase of part of the old Blackburn Water-Works gathering-ground by the Darwen Corporation was under consideration. The sum of £70,000 was asked by the Blackburn Committee; and it was expected that, as the negotiations had been renewed, the Darwen Committee would be prepared to offer something near this sum. They, however, only offered £50,000; and no settlement was arrived at. It is understood that, if the Darwen Committee are not prepared to give the £70,000, or something very near it, negotiations will be finally abandoned.

PROJECTED NEW WATER-WORKS FOR EASINGWOLD.—At the monthly meeting of the Easingwold Union Rural Sanitary Authority last Friday, the detailed estimates prepared by Messrs. Fairbank and Son, Engineers, of Driffield, of the cost of the proposed water-works for the town were considered. The proposal is to supply the lower parts with water in mains from a spring now used by the inhabitants, and which was estimated recently to be yielding 7000 gallons in 24 hours. The water is to be collected into an underground service reservoir close by, to contain 15,000 gallons. Hydrants will be provided in different parts of the town, for use in case of fire. It was resolved to carry out the scheme, the estimated cost of which is £989; and to apply to the Local Government Board for authority to borrow £1000 therefor.

MR. B. A. LEWIS ON COAL GAS.—At the meeting of the Wesleyan Institute, in the Memorial Hall, Cape Town, on the 20th Aug., Mr. B. A. Lewis, Assistant Engineer of Cape Town Gas Company, gave a lecture on "The History and Manufacture of Coal Gas." He commenced by giving an account of the early discoveries which culminated in the introduction of coal gas for illumination; referring, of course, to the labours of Murdoch and Winsor. Coming down to the present system of the manufacture of gas, the appliances for its production, purification, storeage, and distribution were minutely described and illustrated by diagrams and a small retort. The chemical composition of gas was afterwards treated; this part of the subject being rendered more attractive by some interesting experiments. In conclusion, the lecturer pointed out the best mode of burning gas, and exhibited an Argand lamp and a variety of improved burners. The lecture was enlivened by some good stories; and at its close a hearty vote of thanks to Mr. Lewis for his able and instructive discourse was carried by acclamation.

THE EXETER CORPORATION AND OVERHEAD WIRES.—Some sixteen months ago the Exeter City Council gave permission to the local Electric Lighting Company to run their wires along poles fixed in the streets. The Company undertook to remove the posts on receipt of twelve months' notice to do so. Last Wednesday an animated discussion took place at the meeting of the Council, on a motion by Mr. W. H. Dunn—"That notice be given to the Exeter Electric Light Company to determine the permission given them to erect posts in the public streets in connection with the electric light at the earliest possible date." In view of a letter which had been received from the Company stating that they were willing, three years hence, to place the wires now overhead underground, in the most populous parts of the city, if they were allowed to remain overhead in the suburbs and more scattered parts, Alderman Andrew appealed to Mr. Dunn to withdraw his motion. That gentleman said he was not unwilling to modify the terms of the resolution; but observed that it was impossible to go through their streets and not be struck with the inconvenience and danger of these wires and poles. The Mayor ruled that Mr. Dunn could not modify the motion. Mr. Hall, who seconded it, did not see that the resolution, if carried, would interfere with the Company in any way. They would have twelve months' notice; and he only hoped that no great fire would meanwhile take place. If so, they might see the fire-escape prevented by these wires from being put up to get poor people out of the wooden houses of which Exeter was mainly composed. Mr. Blackburn maintained that Exeter was fifty years behind the time in respect of every material improvement. Nothing could be worse than the gas of Exeter. Their guilded chambers were damaged by its fumes; and they all suffered in health from its noxious vapours. Other members ridiculed the suggestion that there was any danger in respect of the overhead wires; and on a division being taken, 11 votes were recorded for, and 25 against the resolution.

THE NORTHERN COAL TRADE.—In the coal trade of the North there has been a further development of the change in the condition of the two branches. The demand for Northumbrian coal shows a falling off (which is usual at this period of the year), and the price is easier in consequence—about 9s. 6d. net per ton being the current price for best Northumbrian qualities, f.o.b. Second qualities are also lower; the price varying from 8s. 6d. to 9s. On the other hand, the demand for the gas coal of Durham is now increasing rapidly, and will continue to be enlarged for perhaps two months. The best gas coal varies in price from 9s. to 9s. 6d. per ton f.o.b.; but perhaps the fairest test is that of the result of the tenders for the supply of the Newcastle and Gateshead Gas Company. These have just been officially decided upon; and whilst one or two of the contracts have been slightly less than 9s., and one or two at 9s. 1½d. per ton, it will be found that the average price of the quantity required—some 150,000 tons—is just about 9s. A year ago it ranged from 6s. to 6s. 1½d.; so that the largeness of the rise in a twelvemonth is at once evident. It is quite expected that the price of gas coal in the open market will further advance before the end of the year. There is very good demand for manufacturing and bunker coals; but that for household coal continues small. Still, apart from the normal decrease in the sales of steam coal, there is a very strong tone in the northern coal trade.

SHARING SURPLUS PROFITS WITH WORKPEOPLE AT COVENTRY.—The Coventry Gas-Fittings Company, Limited, have established a provident fund in connection with their works, by which surplus profits will be shared by the workpeople; and at a meeting of Directors and shareholders on the 19th ult., rules were adopted. The character of the scheme will be understood from the following extracts therefrom:—"From and after the 1st of April, 1889, the surplus (if any) of the clear profits of the business in any financial year beyond 15 per cent. per annum on the paid-up capital for the time being of the Company, which is reserved to the Company for their own benefit, shall be divided into two equal parts, one thereof to be distributed (not of legal right, but gratuitously) as a bonus to the employees in the manner defined by these rules, and the other to be retained by the Company." "The bonus of each employee is to be divided into three equal parts, one whereof will be paid over to him in cash during the week immediately preceding the 30th of June, and the other two will be credited to him in the books of the Company as a provident fund for his benefit. There will be delivered to him a pass-book in which the account of his provident fund will be entered." The distribution of the bonuses confers neither rights nor liabilities of partnership upon the participators. The Manager, the Secretary, and a person nominated by the employees are to form a Consulting Committee under this scheme for the Directors to consult with; but the ultimate decision in any matter will rest with the Directors themselves.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For STOCK MARKET INTELLIGENCE, see *ante*, p. 637.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	11 Apr.	10½	Alliance & Dublin 10 p. c.	10	19—20	..	5 5 0
100,000	10	,,	7½	Do. 7 p. c.	10	13—14	..	5 7 2
800,000	100	1 July	5	Australian (Sydney) 6% Deb.	100	109—111	..	4 10 1
100,000	20	30 May	10	Bahia, Limited	20	26—28	..	7 2 10
200,000	5	15 May	7½	Bombay, Limited	5	7⅞—8	+⅛	4 13 9
40,000	5	,,	7½	Do. New	4	6—6¼	..	5 9 4
880,000	Stck.	14 Aug.	12½	Brentford Consolidated	100	228—233	..	5 5 2
125,000	,,	,,	9½	Do. New	100	163—167	..	5 10 6
220,000	20	12 Sept.	11	Brighton & Hove, Original	20	42—44	..	5 0 0
820,000	20	27 Sept.	11½	British	20	45—47*	..	4 15 9
50,000	10	12 Sept.	11	Bromley, Ordinary 10 p. c.	10	19—21	..	5 4 9
39,000	10	,,	8	Do. 7 p. c.	10	14—16	+1½	5 0 0
328,750	10	30 May	10	Buenos Ayres (New) Limited	10	14—15	..	6 13 4
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	106—109	..	5 10 6
150,000	20	14 Aug.	8	Cagliari, Limited	20	25—27	..	5 18 4
550,000	Stck.	11 Apr.	13½	Commercial, Old Stock	100	269—274	..	5 0 8
130,000	,,	,,	10½	Do. New do.	100	218—218	..	4 18 0
130,000	,,	28 June	4½	Do. 4½ p. c. Deb. do.	100	122—125	..	3 12 4
557,820	20	14 June	18	Continental Union, Limited	20	47—49	..	5 6 2
242,680	20	,,	13	Do. New '69 & '72	14	33—34	..	5 6 7
200,000	20	,,	10	Do. 7 p. c. Pref.	20	37—39	..	5 2 6
75,000	Stck.	27 Sept.	10	Crystal Palace District	100	200-205*	+1½	4 17 7
234,050	10	26 July	13	European, Limited	10	24¼—25½	..	5 1 1
120,030	10	,,	13	Do. New	10	7½ 17½—18½	..	5 5 8
354,060	10	,,	13	Do. do.	5	12—12½	..	5 8 9
5,470,040	Stck.	14 Aug.	13½	Gaslight & Coke, A, Ordinary	100	240—250	−18	5 10 0
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	100—105	..	3 16 3
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	255—260	..	3 16 11
90,000	,,	,,	6	Do. F, 5 p. c. Prf.	100	128—128	..	3 18 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	182—187	..	4 0 4
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	168—171	..	4 1 10
468,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	253—258	..	3 17 6
1,061,150	,,	14 June	4	Do. 4 p. c. Deb. Stk.	100	121—124	..	3 4 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	127—131	..	3 8 8
650,000	,,	,,	6	Do. 6 p. c. do.	100	171—175	..	3 8 6
8,600,000	Stck.	15 May	10	Imperial Continental	100	211—215	..	4 13 0
75,000	5	14 June	6	Malta & Mediterranean, Ltd	5	5—5½	..	5 9 1
660,000	100	1 Apr.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,930	20	14 June	6	Monte Video, Limited	20	21—22	..	5 9 1
150,000	5	30 May	10	Oriental, Limited	5	9—9½	..	5 5 8
60,000	5	27 Sept.	7	Ottoman, Limited	5	6—6¼*	..	5 7 7
166,870	10	26 July	4	Paré, Limited	10	4½—5½	..	7 5 3
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	103—107	..	5 12 1
500,000	100	1 June	6	2nd Do.	100	98—102	..	5 17 8
100,000	10	26 Apr	10	San Paulo, Limited	10	16—18	..	5 11 1
500,000	Stck.	29 Aug.	16½	South Metropolitan, A Stock	100	312—317	..	5 2 6
1,350,000	,,	,,	12½	Do. B do.	100	237—242	..	5 0 2
141,500	,,	,,	13½	Do. C do.	100	250—260	..	5 1 11
600,000	,,	28 June	5	Do. 5 p. c. Deb. Stk.	100	139—143	..	3 9 11
60,000	5	12 Sept.	11½	Tottenham & Edm'nton, Orig.	5	11—13	..	4 8 5
				WATER COMPANIES.				
717,467	Stck.	14 June	9½	Chelsea, Ordinary	100	278—278	..	3 8 4
1,730,560	Stck.	11 Apr.	7½	East London, Ordinary	100	215—220	..	3 8 2
544,440	,,	28 June	4½	Do. 4½ p. c. Deb. Stk.	100	143—146	..	3 1 7
700,000	50	14 June	9	Grand Junction	50	127—133	..	3 8 2
708,000	Stck.	29 Aug.	10½	Kent	100	276—281	..	3 14 9
1,043,800	100	28 June	9	Lambeth, 10 p. c. max.	100	301—306	..	3 7 8
406,200	100	,,	7½	Do. 7½ p. c. max.	100	200—205	..	3 13 2
200,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	118—121*	..	3 6 1
500,000	100	14 Aug.	12½	New River, New Shares	100	360—365	..	3 6 5
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
902,300	Stck.	28 June	6	S'thwk & V'xhall, 10 p.c. max.	100	175—178	−7	3 7 6
1,136,500	100	,,	6	Do. 7½ p. c. do.	100	168—173	..	3 9 4
155,006	Stck.	14 June	10	West Middlesex	100	267—272	..	3 13 6

*Ex div.

GWYNNE & CO., ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS & ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 2698.

Exhausters of nearly all sizes in Stock.

Prize Medals at all the Great International Exhibitions.

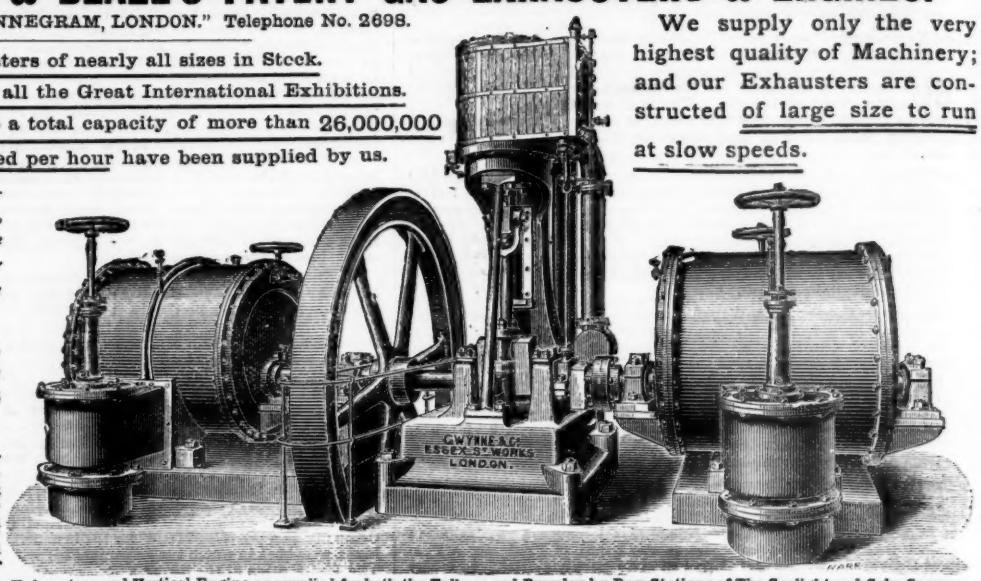
Exhausters equal to a total capacity of more than 26,000,000 cubic feet passed per hour have been supplied by us.

Our new Patent Non-Fluctuating Exhausters, to work without the slightest oscillation or variation in pressure, are strongly recommended.

MAKERS OF EVERY DESCRIPTION OF HYDRAULIC AND GAS MACHINERY.

Gwynne & Co.'s New Catalogue and List of Testimonials can now be obtained on application.

We supply only the very highest quality of Machinery; and our Exhausters are constructed of large size to run at slow speeds.



Exhausters and Vertical Engine as supplied for both the Fulham and Bromley-by-Bow Stations of The Gaslight and Coke Company.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

ANDREW STEPHENSON, Agent for the GAS PURIFICATION AND CHEMICAL COMPANY, Limited, Palmerston Buildings, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / No. 64, BERNARD STREET, LEITH, } SCOTLAND.

SULPHATE of Ammonia Lead Work and Fittings. Lead Burner. Tanks and Saturators made and repaired on the shortest notice.
Address P. J. DAVIES, 78, Earl's Court Road, Kensington, LONDON.

SULPHURIC ACID.

HUGH WALLACE & CO., Chemical Manufacturers (the old-established firm), supply the above, which is specially adapted for making White Sulphate of Ammonia. The latter purchased in any quantities at highest market prices, or contracts for the year.
For price and terms apply Botolph House, Eastcheap, LONDON, E.C.

TAR and Liquor wanted.
BROTHERTON AND CO., Commercial Buildings, LEEDS.

TRAVELLER, calling upon Gas-Works, and having a good Connection among Gas Managers, will be pleased to accept Commissions from one or two Manufacturers of first-class Gas Plant.
Address No. 1752, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a competent Man, a Situation as SERVICE LAYER, METER FIXER, INDEX READER, &c. Eleven years in last Situation.
Address A. B., 16, Station Street, STRATFORD, E.

WANTED, by a young Man, a Situation as SMITH, MAIN and SERVICE LAYER, &c., or would MANAGE a SMALL WORKS, and do all that is required. Steady; age 23.
Address R. I., care of the Manager, Gas-Works, Alton, HANTS.

GOOD Works Foreman wanted for a large Gas-Works in Canada. Must be a man of experience, who has held a similar position before, and has thoroughly good References. Preference will be given to one who has worked Regenerative Furnaces. Salary to commence at £200 a year, with House, Coals, and Gas.
Address, in first instance, No. 1748, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TIMMIS & CO., of STOURBRIDGE
Make only the best quality of FIRE-CLAY RETORTS, BRICKS, TILES, & LUMPS. Also SPECIAL SILICA BRICKS, to stand great heats. All descriptions kept in Stock.
For Prices apply to JAMES LAWRIE AND CO, 1, Whittington Avenue, Leadenhall Street, E.C., Sole Agents for London and District.
Telegraphic Address: "EIRWAL, LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 671 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for Wet and Dry Gas-Meters, Station Meters, and Governors, Pressure-Gauges, Street Lamps, and Pillars, &c.
Telegraphic Address: "Braddock, Oldham."

SHIPPING AND INSURANCE.

FOR Rates of Freight, &c., apply to ROBERT BRUCE FITZMAURICE, 9, Crosby Square LONDON, E.C.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

THE Ennis Gas Consumers' Company require the services of a MAN, competent to undertake the Management of the Works, and also act as Gas-Fitter.
Apply to the SECRETARY, Gas-Works, ENNIS.

WANTED, a thoroughly practical Manager for Works making about 80 million feet per annum. Must be a strict disciplinarian, and possess good general knowledge of all routine Work.
Address, giving reference and Salary required, to the CHAIRMAN, Gas Company, GLOSSOP.

WANTED, a Stoker, used to Engine and Exhauster. Permanent employment to a steady Man. Wages, 28s. per week. Sundays off during the greater portion of the year.
Apply to Mr. J. H. SILCOX, Manager, Gas-Works, Pembroke Dock, SOUTH WALES.

WANTED, as Gas-Stove Salesman, an experienced Man. Must thoroughly understand Gas-Stoves of all kinds, and be able to keep the Books of the Department.
Apply, by letter, enclosing testimonials, and stating Age and Salary required, to No. 1751, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, immediately, a good Main and SERVICE LAYER. One used to Gas-Works Plant, and with a knowledge of Smith's Work preferred. Must be a total abstainer.
Applications to state Wages expected; and testimonials as to Character, &c., to be sent to the MANAGER, Gas-Works, TROWBRIDGE.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased.
120 and 121, NEWGATE STREET, LONDON, E.C.

TUBES.

FOR Gas, Steam, and Water; Galvanized, White Enamelled, and Hydraulic Tubes and Co.
JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID for making SULPHATE OF AMMONIA of high quality and colour. *Delivery in Railway Tank-Wagons or Carboys.*
Highest References and all particulars supplied on application.

HUTCHINSON BROTHERS, Barnsley, Gas Engineers and Contractors, Makers of Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Tools, and Sundries.
*** See large Advertisement in last week's issue, page 584.

SULPHURIC ACID, B.O.V., for Sulphate of Ammonia Making. Guaranteed clear, of full strength, and to produce a fine white-coloured salt, Delivered in carboys or railway tank waggons.
For prices and terms address BALE, BAKER, AND CO., 120 & 121, Newgate Street LONDON.

ESTABLISHED 1869.

HYDRATED Oxide of Iron (Bog Ore).
Purity and Uniformity of Quality guaranteed. Stocks kept at MINES for direct Shipments to any Port, also at Garston Docks.
GEO. G. BLACKWELL, Mine Proprietor, 25, 26, and 27, Irwell Chambers, W. LIVERPOOL.

COKE CLERK.

WANTED, a junior Coke Clerk at a Gas-Works near London. One who has filled a similar office preferred. Salary to commence at £60 per annum, paid monthly.
Address No. 1753, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—2000 tons of the Purest OXIDE OF IRON (Bog Ore).
Apply, by letter, to No. 1749, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Single Gasholder, 60 feet diameter by 23 feet deep. Capacity, 65,000 cubic feet; fixed complete; in good condition.
Also four PURIFIERS in a line, 14 ft. square by 4 ft. deep, with Centre-Valve and Connections, Wrought-Iron Covers, Lifting Gear, and Crab complete. Makers, Messrs. C. & W. Walker.
Also four PURIFIERS in a group, 16 ft. by 12 ft. by 3 ft. 9 in. deep; 12-inch Centre-Valve and Connections.
Would erect the above and make practically equal to new.
Inquiries invited for various second-hand Gas Plant—Gasholders, Tanks, Purifiers, Washers, Exhausters, Station Meters, &c.
Apply to SAML. WHILE (late Ashmore and While), 60, Queen Victoria Street, LONDON, E.C.

LAMPS for Sale. Seven 10-feet Fluted Cast-Iron Columns, fitted with seven Schülke Lamps and Burners complete; recently in use.
Apply to GARRETT AND CO., LIMITED, 48 to 49, Powis Street, WOOLWICH.

SOUTH METROPOLITAN GAS COMPANY.

£50,000 Five per Cent. Perpetual Debenture Stock of the above Company, presenting an Investment of the soundest description.

MR. G. A. WILKINSON is instructed by the Directors to SELL by AUCTION, at the Mart, on Friday, Oct. 18, at Two o'clock precisely, in numerous Lots, to suit large and small Purchasers, £50,000 FIVE PER CENT. PERPETUAL DEBENTURE STOCK in the SOUTH METROPOLITAN GAS COMPANY.
The Districts supplied by the Company comprise nearly the whole of the South of London, from Wandsworth to Plumstead Marshes, and the demand has so much increased that the supply of Gas has been nearly doubled within the last Ten years.
Particulars may be had of FRANK BUSH, Esq., Secretary to the Company, 709A, OLD KENT ROAD; of Messrs. JOHNSON, BUDD, and JOHNSON, Solicitors, 24, AUSTIN FRIARS; and of Mr. G. A. WILKINSON, Auctioneer and Land Agent, 7, Poultry, CITY.

SPENT OXIDE.

THE Worksop Gas Company have about 45 tons of SPENT BOG ORE ready for delivery, which may be seen at the Works.
Tenders, at price per ton, to be sent to the Manager.
Payment, cash on delivery.

TENDERS FOR TAR.

THE Directors of the Swansea Gaslight Company are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works for the Twelve months commencing the 1st of October, 1889.
Delivery into Tank Vessels, South Docks, or into Tank Trucks, Gas-Works, Swansea (in communication with all Railways).
Tenders to be delivered, by the 4th of October, to me, the undersigned, from whom all information may be obtained.

By order,
THORNTON ANDREWS.
Gas-Works, Swansea.

COUNTY BOROUGH OF STOCKPORT.

TO GASHOLDER MAKERS.

CONTRACT No. 2.

THE Gas Committee are prepared to receive TENDERS for Supplying, Fixing, and Completion of a TELESCOPE GASHOLDER; the inner Lift being 145 ft. 6 in. in diameter and 32 ft. 6 in. deep, with all necessary Guides, Wheels, Columns, and Girders complete; to be erected at their Portwood Gas-Works, Stockport.
Drawings and specifications may be seen on application at the Portwood Works.
Sealed tenders to be sent in on or before Tuesday, Oct. 15 next, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gasholder."
The Committee do not bind themselves to accept the lowest or any tender.

JAMES JACQUES,
Engineer and Manager.
Stockport, Sept. 19, 1889.

BOROUGH OF ROCHDALE.

OXIDE OF IRON.

THE Gas Committee of the Rochdale Corporation invite TENDERS for the supply of 150 tons of NEW OXIDE OF IRON, and also for the purchase of about 500 tons of SPENT OXIDE (artificial), containing about 50 per cent. of Sulphur and 8 to 10 per cent. of Moisture, samples of which may be obtained on application to Mr. T. Banbury Ball, the Manager at the Gas-Works.
Tenders, endorsed "Oxide," must be sent to me not later than Noon, on Wednesday, the 9th of October next.

By order,
ZACH. MELLOR, Town Clerk.
Town Hall, Rochdale, Sept. 26, 1889.

TENDERS FOR GAS COAL.

THE Directors of the Bradford-on-Avon (Wilts.) Gas and Coke Company, Limited, are prepared to receive TENDERS for the supply of 1000 tons of GAS COAL, delivered free at the Great Western Railway Station, or at the Canal Wharf, Bradford-on-Avon, in such quantities as required for the period of One year, commencing from Dec. 1 next.
Tenders, endorsed, and addressed to the undersigned, to be sent in not later than Saturday, Oct. 19.
The Directors do not bind themselves to accept the lowest or any tender.
No forms of tender provided.

By order,
H. A. SUMMERS, Secretary.
Gas Offices, Bradford-on-Avon, Wilts.

LEIGH LOCAL BOARD.

THE Gas Committee of the Leigh Local Board invite TENDERS for the Supply and Erection of two Wrought-Iron HYDRAULIC MAINS, 56 ASCENSION, BRIDGE, and DIP PIPES, and sundry VALVES and CONNECTIONS.
Drawings may be seen, and a copy of specification obtained, on application to the undersigned.
Sealed tenders, endorsed "Ironwork," and addressed to Mr. Alderman Thorp, Chairman, to be delivered at the Town Hall, Leigh, not later than Monday, the 7th of October next.
The lowest or any tender not necessarily accepted.

ALFRED T. FLETCHER,
Engineer and Manager.
Gas-Works, Leigh, Lancs., Sept. 18, 1889.

BRISTOL UNITED GASLIGHT COMPANY.

TENDERS FOR TAR.

THE Directors of this Company invite TENDERS for the purchase of the TAR to be produced at all or either of their three Stations, during a period of One, Two, or Three years, commencing on the 1st day of January, 1890.
The annual quantities of Tar produced at each of the Stations at present are approximately as follows:—

Avon Street	595,000 gallons.
Canons' Marsh	470,000 "
Stapleton	450,000 "

Further particulars, with forms of tender, may be obtained on application to the undersigned, to whom also tenders sealed, and endorsed "Tender for Tar," must be delivered not later than Ten a.m., on Monday, the 4th day of November prox.

JAMES V. GREEN, Secretary.
Gaslight Offices, Canons' Marsh,
Sept. 20, 1889.

THE Corporation of Halifax are pre- pared to receive TENDERS for the Supply and Fixing of Four PURIFIERS, each 27 feet square, with Wrought-Iron Covers, Centre-Valve, and Connections complete.
Specification, with forms of tender, and all particulars, may be obtained on application to the Gas Engineer, Mr. Thomas Holgate.
Sealed tenders, endorsed "Purifiers," are to be sent to the undersigned not later than Ten a.m., of Friday, the 4th of October, 1889.

By order,
KEIGHLEY WALTON, Town Clerk.
Town Hall, Halifax, Sept. 19, 1889.

THE Corporation of Halifax are pre- pared to receive TENDERS for the Supply and Fixing of the CAST-IRON COLUMNS, CAST-IRON GIRDERS, and WROUGHT-IRON GIRDERS required for the support of four new Purifiers, about to be erected at their Works.
Specifications, with form of tender, and all particulars, may be obtained on application to the Gas Engineer, Mr. Thomas Holgate.
Sealed tenders, endorsed "Tender for Girders," are to be sent to the undersigned not later than Ten a.m., on Friday, the 4th of October, 1889.

By order,
KEIGHLEY WALTON, Town Clerk.
Town Hall, Halifax, Sept. 19, 1889.

TO INVENTORS AND PATENTEES.

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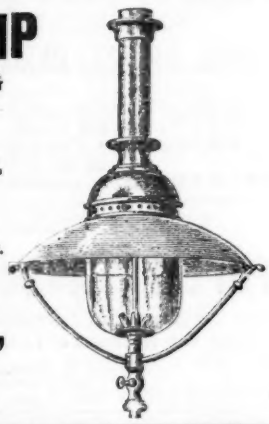

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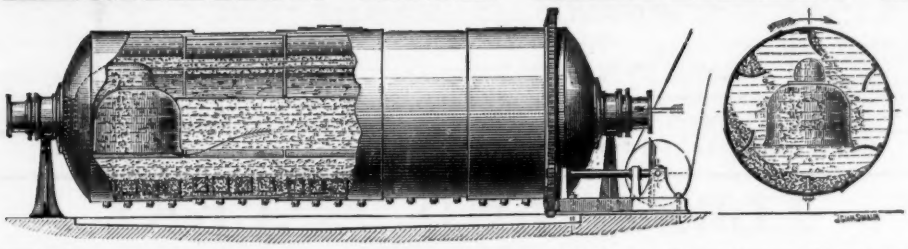

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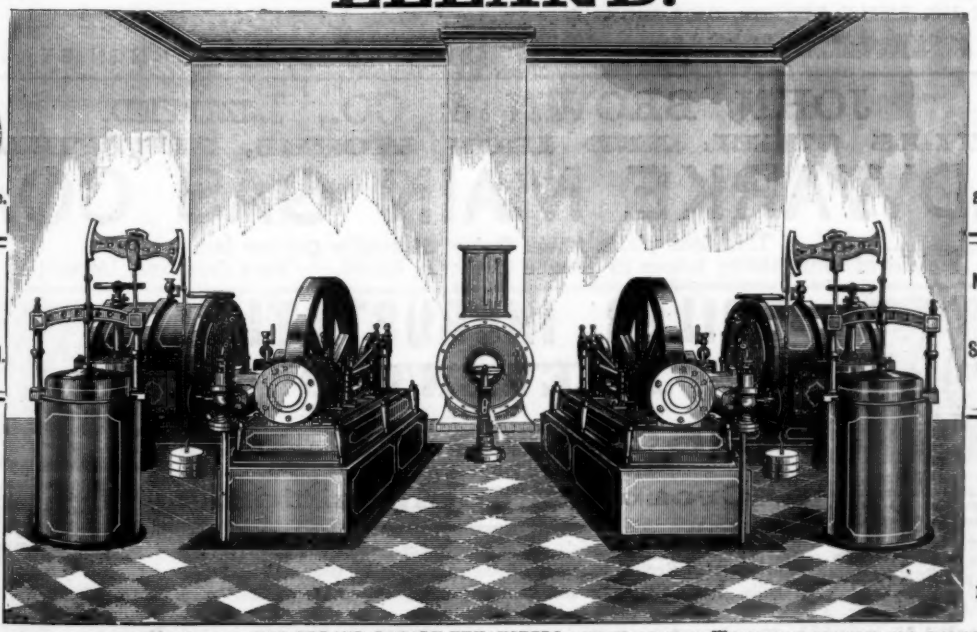

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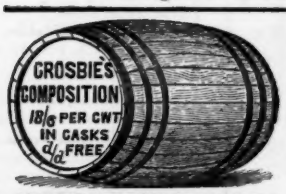

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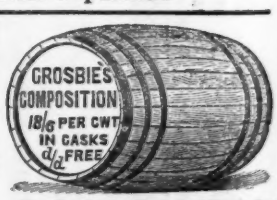
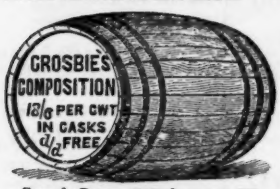


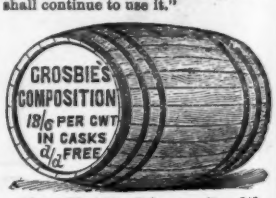
The Pembroke Dock and Town Gas Company write: "Your Boiler Composition is giving satisfaction; and we shall continue to use it."



Sample Drums 20s. per cwt. d/d.

Scores of Testimonials can be had on application, and references can be given to Engineers, Colliery-Owners, Iron-Works, Cotton-Mills, Paper-Mills, Woollen-Mills, Brewers, Ship-Owners, Gas-Works, Glass-Works, Dyers, Printers, and, in fact, to Steam Users in almost **every Branch of Trade.**

"CROSBIE'S COMPOSITION" is testified by leading Analysts as **absolutely harmless to Metals,** and is certainly the most **economical** means of preventing Incrustation that it is possible to obtain.



Also sold at 2s. 3d. per gallon d/d.

ADOLPHE CROSBIE, Walsall Street Chemical-Works, WOLVERHAMPTON.

WATER GAS FUEL GAS

FOR INDUSTRIAL PURPOSES

GENERATED FROM

BITUMINOUS SLACK COAL

BY THE

LOOMIS PROCESS.

The Cheapest Gas-Generating System in the World.

NOVEL IN DESIGN.
MODERN IN CONSTRUCTION.
SIMPLE IN OPERATION.
PERFECT IN RESULTS.

PROCESS AND APPARATUS PATENTED IN ALL COUNTRIES.

By this system more gas, and of a higher heating power per cubic foot, can be generated from a ton of Bituminous Slack Coal than by any other from a ton of Anthracite Coal or Coke.

The successful application of Water Gas for industrial purposes was brought about through this Process at the Works of the—

JOHN RUSSELL CUTLERY COMPANY, Turner's Falls, Mass., where it has been in daily use upwards of two years, doing all the Forging, Hardening, and Tempering.
HENRY DISSTON & SONS, Steel, Saw, and File Works, Philadelphia.
AMERICAN WALTHAM WATCH COMPANY, Waltham, Mass.
ADDYSTON PIPE AND STEEL COMPANY, Cincinnati.

Many other industrial establishments in America are successfully using this Process, and a large number of Works are now being erected including a plant at Brussels and at Sheffield (at Messrs. Thomas Firth and Sons, Limited).

This process is especially adapted for firing all classes of Pottery, Tile, and Brick Kilns.

For particulars apply to

NEWTON, CHAMBERS, & CO., LIMITED,
THORNCLIFFE IRON-WORKS, near SHEFFIELD.

THE GAS APPARATUS Co., PETERBOROUGH,

GAS ENGINEERS,

Manufacturers, Gas-Works Furnishers,

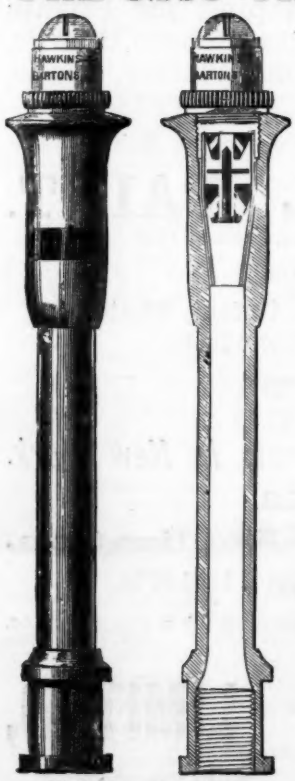
AND MAKERS OF ALL KINDS OF

Gas Burners, Governors, Lamps, Gauges,

AND SPECIALTIES OF EVERY DESCRIPTION.

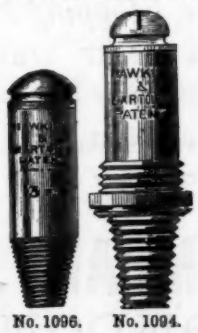
ALSO SOLE MANUFACTURERS OF

Hawkins & Barton's Patent Self-Regulating Lamp Governors and Burners.



Full Size, No. 1098.

These Governors are made to take to pieces for cleaning and re-adjusting.



No. 1096. No. 1094.

An enormous quantity of these Burners are in use in this Country and abroad; and they have never failed to give satisfaction. Wherever they are adopted, complaints against Bad Gas and Excessive Gas Bills naturally cease. Owing to their extreme simplicity, they cost less than half that of any others, and will last years without attention.

Trial Orders Solicited.

PRICES AND TERMS ON APPLICATION.

Works & Offices: PETERBOROUGH.

REPORTS

By T. NEWBIGGING, Esq., C.E
Feb. 25, 1889.

Burner tested, 4 feet.
Pressure, 10, 15, 20, 25 tenths.
Consumption, 4, 4, 3·95, 3·8 feet.

By G. BOWER, Esq, C.E.,
St. Neots, *March* 12, 1889.

"I have tested your Pressure Regulating Burners; and I find that those you sent me do not vary more than two-tenths under pressures varying from six to forty tenths. I shall not only use them myself, but I shall recommend others to use them."

By J. MACKAY, Esq., Engineer, Gas-Works, Peterhead,
July 18, 1889.

"The enclosed Burner has been in use here all last winter, and does not seem much the worse. We had seven different kinds of Governors on trial, and yours seemed to come out the best. Please send us five gross more of the same kind."

Awarded FIRST PRIZE MEDAL at the Falmouth Royal Polytechnic Exhibition, 1889.

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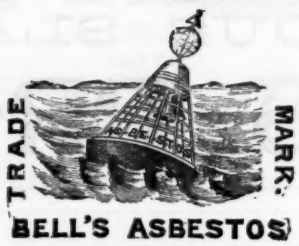

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IS FIRE RESISTING.
IS WASHABLE.
IS NON-POISONOUS.
IS MANUFACTURED IN ALL USEFUL COLOURS.
IS IMPERVIOUS TO HEAT, COLD, OR WATER.
IS WITHOUT SMELL.

No expensive Oil or Turpentine required.

WILL NEVER BLISTER.

HAS A COVERING CAPACITY 40 PER CENT. GREATER THAN LEAD PAINTS.

For Outside or Inside Work in any Climate.

Bell's Asbestos Aquol Paint is equally suitable for the finest decorative work as well as for general painting. It can be applied over or under any other paint, and, owing to its easy application, can be used with a large distemper brush; the SAVING THUS EFFECTED IN LABOUR BEING 50 PER CENT. OVER THAT OF LEAD PAINTS.

Bell's Asbestos Aquol Paint is susceptible of the most delicate treatment; and, owing to its perfect flatted surface, it brings up the varnish in a manner that no other paint can equal. ONE COAT OF VARNISH ON **Bell's Asbestos Aquol** IS EQUAL TO TWO COATS ON ORDINARY PAINT.

BELL'S ASBESTOS AQUOL PAINT is specially adapted for Private Houses, Exhibition Buildings, Ships, Churches, Asylums, School Boards, Railway Stations, and all work of Wood, Iron, Cement, Plaster, Stone, Brick, &c., &c.

Those who Study Economy and Protection from Fire should use only

BELL'S ASBESTOS AQUOL PAINT.

BELL'S ASBESTOS AQUOL PRIMING is made Ready for Use.
BELL'S ASBESTOS AQUOL PRIMING stops all suction of Wood, Cement, Plaster, &c.
BELL'S ASBESTOS AQUOL PRIMING should be applied to all New Work.

Suitable for Ceilings, Walls, and New Wood, and is very durable.

BELL'S ASBESTOS AQUOL KNOTTING, for Stopping Knots in New Work.

AN EXCELLENT CURE FOR DAMP WALLS.

Colour Cards and Price Lists on Application.

Supplied in Casks of 5 to 7 cwt., and Iron Drums of 28, 56, and 112 lbs., Sample Tins of 7 and 14 lbs.

Owing to its Covering Capacity, a SAVING IN FREIGHT of 40 per cent. is effected for a given surface.

BELL'S ASBESTOS COMPANY, LIMITED,

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DEPOTS—MANCHESTER: Cable Street, Blackfriars. LIVERPOOL: 2, Strand Street, James Street.
CARDIFF: West Bute Street. BIRMINGHAM: 7, John Bright Street. HULL: Humber Dock Basin.
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The above, which can only be obtained from this house, is recognized as the **most efficient and economical jointing material in use.** It is composed of a specially-prepared India-rubber Compound, protected by a covering of Vulcanized Asbestos Sheeting, as shown above; and as it is the only Jointing Material which adequately **combines permanent elasticity with heat resistance,** the advantage it possesses will at once be seen.

EXPANSION RINGS.

The centre from which the requisite elasticity is obtained will adapt itself to uneven surfaces to which it may be applied, and allow the expansion and contraction to be fully taken up. The covering being of Asbestos Cloth imparts a protection to the centre, and so prolongs its elasticity. **For Manhole, Mudhole, Steam Pipe, and Mash Tun Door Joints, it is unequalled;** and if applied as directed, **a ring can be used many times over.**

Made from 1-Ply for Cylinder and Faced Joints to any thickness for Uneven Surfaces.

BELL'S ASBESTOS CO., Ld.

DEPÔTS.

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Is the BEST LOCOMOTIVE PACKING made.

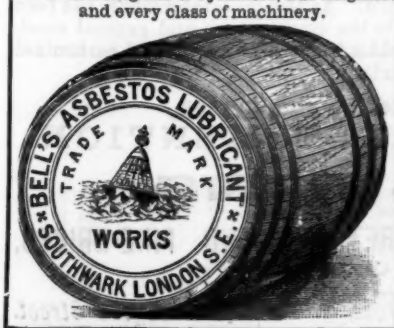
BELL'S

COMPOUND HYDRAULIC PACKING

Is specially suited for Hydraulic Machinery, Accumulators, and Ammonia and all Pumps.

BELL'S ASBESTOS LUBRICANT

Is unequalled
For Steam-Engines & Cylinders, Gas-Engines, and every class of machinery.



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The reputation of this Lubricant is based on the experience of thousands of users, which places it far in advance of those who rely only on mere laboratory tests.

ASBESTOLINE IS THE CHEAPEST MOST EFFICIENT, CLEANEST MOST INODOROUS AND SAFEST LUBRICANT.

ASBESTOLINE HAS SAVED 90 PER CENT. OVER OIL.

Has been used for all purposes, AND BEATEN ALL OTHER LUBRICANTS IN ACTUAL WORK.

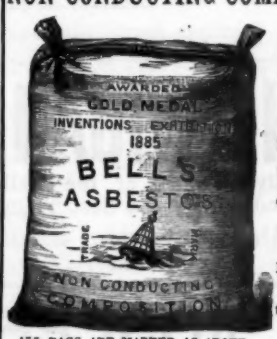
BELL'S ASBESTOS

"DAGGER" PACKING

Is unequalled for every kind of Marine and Land Engine, Steam-Pumps, &c., and has proved itself to be the most efficient, durable, and economical Packing made.

BELL'S ASBESTOS

NON-CONDUCTING COMPOSITION.



ALL BAGS ARE MARKED AS ABOVE.

Will reduce loss by radiation, and saves 40 per cent. of fuel.

Is suitable for boilers with flat or round bottoms. Is superior to any other, and saves its cost in a few months.

Is sent out dry in bags; therefore cheaper than others sent out wet.

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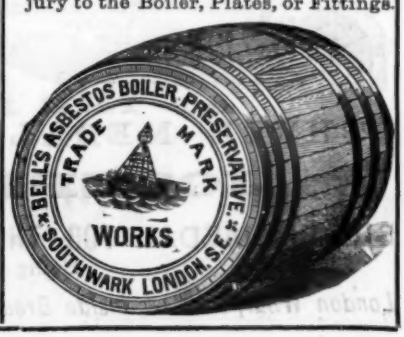
Will effectually keep Boilers clean, and remove any Incrustation, without injury to the Boiler, Plates, or Fittings.



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ETNA WORKS,

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PATENTEES AND MANUFACTURERS OF

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and Manufacturers of every description of

Gas Apparatus

Cast and Wrought Iron Tanks, Purifiers, Condensers, Scrubbers, Retort-Lids, Cross-Bars and Screws, Wrought-Iron Boilers for Stationary, Portable, and Marine Engines, Sugar Pans, Coolers, Clarifiers, Punts, Boats, Bridges, Girders, Roofs, Cisterns, Oil-Tanks, Melting-Pots, Crucibles, Salt-Pans, Arch and Range Boilers, and every description of General Ironwork.

Drawings, Specifications, and Estimates supplied.

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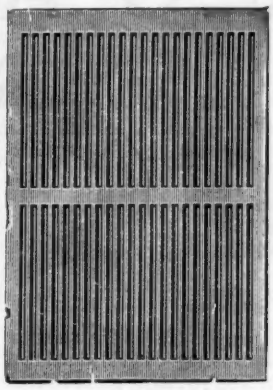

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Made from any kind of Timber, of any Size or Shape, by trained Workmen and specially-designed Machinery.

Quick delivery and accuracy guaranteed.

BOARDS FOR SCRUBBERS

Cut and fitted upon the most successful system.

GRIDS FOR SULPHATE PLANTS.

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THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

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SILVER MEDAL FOR THEIR PATENT MACHINE-MADE RETORTS AND FIRE-BRICKS,

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Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

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Ironfounders, Gas and General Engineers,

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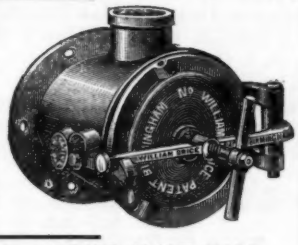
To suit all sized sections of Retort. Over 70 stock sizes. Largely used in England.

Grice's Patented Stoking Machinery.

Made to suit large or small Gas-Works. The one machine draws the spent coke and recharges the Retort at one operation. Self-contained; working from engine on base or by hand. Price and particulars on application.



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Machine-Moulded Spur, Bevel, Mitre, and Helical Wheels and Pulleys, to 20 feet diameter.

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As supplied to the English Railway Companies.

MORTAR & LOAM MILLS,

With or without Engines.

PUNCHING AND SHEARING MACHINERY

Of all Kinds.

ENGINES. Vertical and Horizontal; High and Low Pressure CONDENSING BOILERS; Tubular and Ordinary CASTINGS, All descriptions up to 15 tons.

SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

DR. FELDMANN'S APPARATUS

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO THE

Sole Agents and Manufacturers,

GODDARD, MASSEY, & WARNER, ENGINEERS,

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The Apparatus has been supplied to the following Firms—

BURT, BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
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And to the following Gas Companies and Corporations:—

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DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
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CONTRACTING GAS ENGINEERS.

SPECIALITIES.

Patent Regenerative Retort-Settings.

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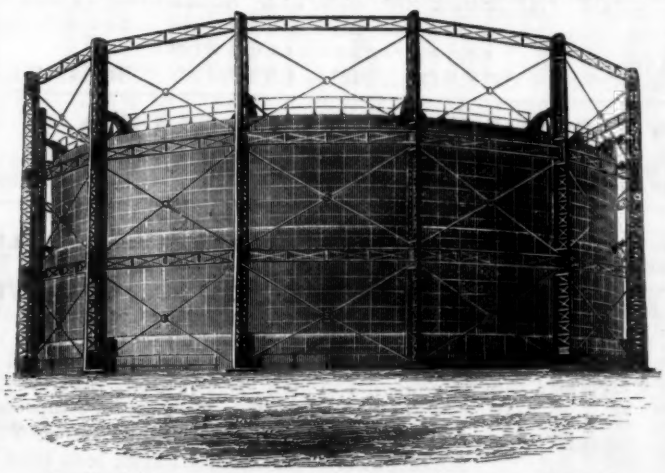
Patent Reciprocating Exhauster.

Patent Regulator.

Patent Anti-Dip Pipes.



Treble-Lift Gasholder, 130 ft. by 60 ft., as erected at Burton-on-Trent.

SOLE MAKERS OF

DRAKE'S PATENT GAS PLANT

Specially adapted for Country Places, and for mixing with Coal Gas to increase Illuminating Power.

Condensers, Scrubbers, Purifiers, and all Fittings for Gas-Works.

IMPROVED CHEMICAL PLANT.

WHITESTONE IRON-WORKS,

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WEST'S GAS IMPROVEMENT CO., LIMITED,

Engineers, Ironfounders, and Contractors,

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MANUFACTURERS OF

WEST'S PATENTED MACHINERY

FOR

CHARGING AND DRAWING GAS-RETORTS.

OVER 160 MACHINES AT WORK AND IN COURSE OF CONSTRUCTION.

ADVANTAGES ATTENDING ITS USE ARE:—

INCREASED VOLUME of GAS per TON and INCREASED YIELD per Retort.—The system of breaking and distributing the coals in an even layer in the retorts effecting more perfect carbonization.

REDUCTION in LABOUR and COST of WORKING.—In Works where this System of charging and drawing Retorts is adopted, there has been effected a substantial saving in the cost of Gas Manufacture in the Retort-House; the amount saved varying in different Gas-Works from **8 PENCE** to **15 PENCE** per Ton of coal carbonized. Full particulars will be forwarded upon application to W. G. I. Company, Limited.

MANUAL CHARGING AND DRAWING MACHINES.

POWER CHARGING AND DRAWING MACHINES, driven by Wire Rope, Steam, or Compressed Air.—The power machines are applicable to circular, oval, or Ω-shaped retorts and mouthpieces, and are the most perfect, economical, efficient, and durable machines made; they are constructed on principles founded by long and extensive experience in this special branch of gas engineering and the manufacture of gas.

Sole Makers of **CIRCULAR, OVAL,** or Ω-shaped **MOUTHPIECES,** with Morton's Self-Sealing Lids, fitted with

KING'S PATENT FASTENINGS,

which, by a simple wedging action at each end of the crossbar, secure a very tight joint; and at the same time, by their long sliding motion, they effectually remove the tar or other matter from the surfaces of the mouthpiece and lid.

N.B.—The whole of these Fittings are made of Wrought Iron.

Estimates and further particulars forwarded upon application for Mouthpieces complete, or for Lids and Fastenings separately.

MAKERS OF THOMAS AND SOMERVILLE'S COKE-BREAKING MACHINE.

SOLE MAKERS OF WHITE'S PATENT AUTOMATIC GAS-VALVE.

Mr. JOHN WEST, M. Inst. C.E., Managing Director.

ILLUSTRATED CATALOGUE SENT UPON APPLICATION.

G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR,

PATENTEE OF

A SPECIAL COMPOUND

FOR THE CURE OF STOPPED ASCENSION-PIPES,

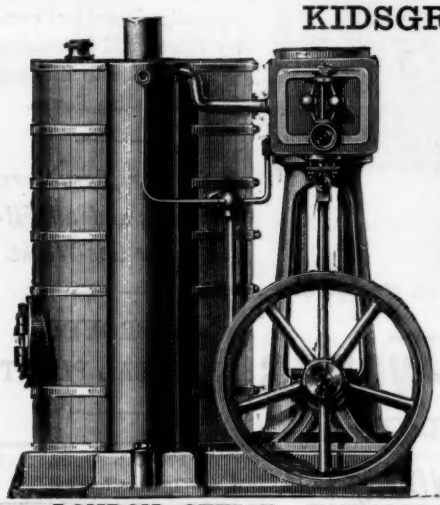
A couple of charges of which will clear a stopped pipe, and an occasional charge keeps them clean, and also increases the make per ton and the illuminating power

PRICE AND PARTICULARS ON APPLICATION.

Head Office: CORPORATION STREET, BIRMINGHAM.

RENSHAW, KING, & Co.,

KIDSGROVE, STAFFORDSHIRE,



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PRIME MOVER, suitable for Tram Cars, Yachts, Hoists, Dynamos, Pumps, and Driving Machinery in Gold Mining, Crushing, Grinding, Cutting, Printing, Ventilating, Farming, &c., &c.

ADVANTAGES: Cost of Fuel ONE FARTHING per hour per horse power. 50 PER CENT. less than Gas-Engines. Absolute safety. Entirely Automatic. Only attention required being for fire at long intervals.

ANY FUEL CAN BE USED.

Furnishes abundance of hot water for heating or other purposes, without affecting motive power.

IS PRACTICALLY NOISELESS, NO SMELL, SMOKE, OR NUISANCE.

PRICE: Half-H.P., £54. 1-H.P., £73. 2-H.P., £105.

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